



A-1  
5-8

NATIONAL LIBRARY OF MEDICINE  
Bethesda, Maryland

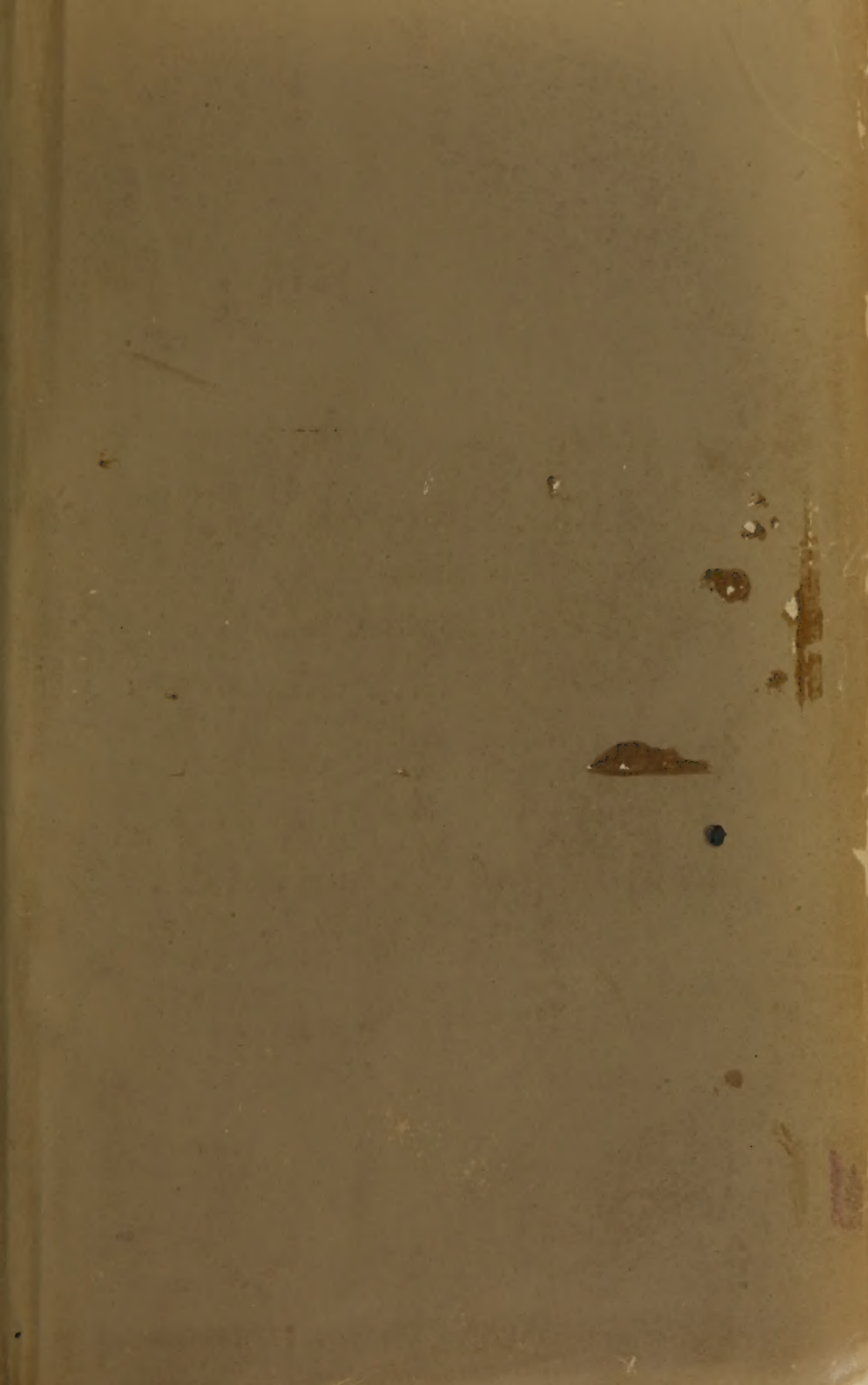


SECTION .....

SHELF .....

Works of this Section cannot be taken from the Library except by written permission of the Bureau of Medicine and Surgery.

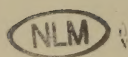




A-1  
S-8









PHILADELPHIA,  
October, 1871

LINDSAY & BLAKISTON'S  
NEW MEDICAL PUBLICATIONS,  
AND  
NEW EDITIONS,

ISSUED DURING THE PRESENT SEASON.

*Trousseau's Clinical Medicine.* Volume IV.

FROM THE THIRD REVISED AND ENLARGED EDITION.

Lectures on Clinical Medicine, delivered at the Hotel Dieu, Paris, by A. TROUSSEAU, late Professor of Clinical Medicine, in the Faculty of Medicine, Paris, &c., &c. Vol. IV, Translated from the Third Revised and Enlarged Edition, by JOHN ROSE CORMACK, M.D., under the auspices of the NEW SYDENHAM SOCIETY of London, and published in the United States by arrangement with them. Octavo, Cloth. Price, . . \$4.00

CONTENTS OF VOLUME IV.

LECTURE 68, Dyspepsia; 69, Chronic Gastritis; 70, Simple Chronic Ulcer of the Stomach; 71, Diarrhœa, Chronic Diarrhœa; 72, Infantile Cholera, Diarrhœa of Children; 73, Lactation, First Dentition, and the Weaning of Infants; 74, Dysentery; 75, Constipation; 76, Fissure of the Anus; 77, Intestinal Occlusions; 78, Hepatic Colic, Biliary Calculus; 79, Hydatid Cysts of the Liver; 80, Malignant Jaundice; 81, Syphilis in Infants; 82, Gout; 83, Nodular Rheumatism, erroneously called Rheumatic Gout; 84, Acute Articular Rheumatism, and Ulcerating Endocarditis.

RECENTLY PUBLISHED.

Volumes I, II, and III of the same work, handsomely bound in cloth to match.  
Price, \$5.00 each.

Trousseau's Lectures on Clinical Medicine, so favorably received, as well by the profession of the United States as abroad, are published in this country in connection with the New Sydenham Society, under whose auspices the translation of Vols. II, III and IV have been made. Either volume can be furnished separately, and in order to still further extend the circulation of so valuable a work, the Publishers have reduced the price of the first three volumes to *Five Dollars* per volume, and will furnish Vol. IV at *Four Dollars*.

"Trousseau furnishes us with an example of the best kind of Clinical Teaching. It is a book that deserves to be popularized. The translation is perfect."—*Medical Times and Gazette*.

"The great reputation of Prof. Trousseau as a practitioner and teacher of Medicine in all its branches, renders the present appearance of his Clinical Lectures particularly welcome."—*Medical Press and Circular*.

"The publication of Trousseau's Lectures will furnish us with one of the very best practical treatises on disease as seen at the bedside."—*British and Foreign Medico-Chirurgical Review*.

"A clever translation of Prof. Trousseau's admirable and exhaustive work, the best book of reference upon the Practice of Medicine."—*Indian Medical Gazette*.

"The Lectures of Trousseau, in attractiveness of manner and richness of thoroughly practical matter, worthily takes a place beside the classical lectures of Watson and Graves."—*British Medical Journal*.

"Trousseau is essentially the French Graves, and his lectures should sooner than this have been translated into English."—*Lancet*.

*Growths in the Larynx*, THEIR HISTORY, CAUSES, SYMPTOMS, DIAGNOSIS, PATHOLOGY, PROGNOSIS, AND TREATMENT, with Reports and an Analysis of one hundred Consecutive Cases treated by the author, and a Tabular Statement of every published case treated since the invention of the Laryngoscope. By MORELL MACKENZIE, M.D., Physician to the Hospital for Diseases of the Throat, author of "The Laryngoscope," "Diseases of the Throat," &c. Profusely illustrated by 87 elegantly executed Wood Engravings, together with a number of Lithographic figures, and Chromo-Lithograph, or Colored, Illustrations, forming a handsome Octavo volume, printed on Cream Tinted Paper. Price, \$3.00

"This book is undoubtedly the most complete and original essay on new formations in the Larynx which has appeared in this country. The author's comparisons of the merits of the operations, and the rules he lays down for the guidance of the practitioner, are by no means the least valuable portion of a book, which we can cordially recommend to our readers."—*Medical Times and Gazette*.

"The Use of the Laryngoscope in Diseases of the Throat, and Essays on Growths in the Larynx, are two monographs of first-rate merit. Dr. Mackenzie's Essays would do honor to any place; and he has used the opportunities afforded to diligence and skill to make solid and enduring contributions to science and practice. Both works are, throughout, models of honest and complete work, and are honorable to British medicine, as they are useful to practitioners of every country. The completeness of the clinical records, the abundant graphic illustrations, and the fulness of bibliographical references, are excellent features in both volumes."—*British Medical Journal*.

BY SAME AUTHOR, SECOND EDITION.

*The Use of the Laryngoscope in Diseases of the Throat*. With an appendix on Rhinoscopy, and an Essay on Hoarseness, and Loss of Voice, with additions, by J. SOLIS COHEN, M.D., Author of "Inhalation, Its Therapeutics and Practice," &c. Illustrated by two Lithographic Plates, and 51 Engravings on Wood. Price, . . \$3.00

*Acton's Functions and Disorders of the Reproductive Organs in Childhood, Youth, and Advanced Life*.

By WILLIAM ACTON, M.D. Third American from the Fifth London Edition. Octavo. Price, . . . . . \$3.00

"Mr. Acton has devoted himself for many years with unwearying assiduity to the study of the diseases of the reproductive organs, after an intimate acquaintance with syphilitic diseases gained in the Clinique of M. Ricord; and we accordingly find that whether as regards the structure, the functions, or the diseases of the organs in question, every circumstance has received the minutest attention. . . . ."—*Medical Times and Gazette*.

"In the work now before us, all essential detail upon its subject-matter is clearly and scientifically given. We recommend it accordingly, as meeting a necessary requisition of the day."—*The Lancet*.

"We think Mr. Acton has done good service to society by grappling manfully with sexual vice, and we trust that others whose position as men of science and teachers enable them to speak with authority will assist in combating and arresting the evil which it entails. We are of the opinion that the spirit which pervades it is one that does credit equally to the head and to the heart of the author."—*The British and Foreign Medico-Chirurgical Review*.

*Gant's Science and Practice of Surgery*.

A Complete Text-Book including the Principles and Practice, by FREDERICK J. GANT, F.R.C.S., Surgeon to the Royal Free Hospital, London, &c., &c. With 471 Illustrations, and over 1100 Octavo pages. Price, . . \$7.50

Dr. Gant's Surgery is similar in its general features to Dr. Errickson's excellent Text-Book on the Science and Practice, as comprising the *whole* of surgery, but it will have the great advantage of being an entirely new work, and appearing in a greatly condensed form, without the omission of any important subject. The matter throughout is fully brought up to the present time,—many original sources of information, including the best treatises in Holmes's System of Surgery, having been utilized, which have not heretofore been gathered into any general work on surgery, thus making it a more complete book for the student, and a work of ready reference for the practitioner. It is also illustrated by 471 new illustrations, which add much to its value.



## *Pereira's Physicians' Prescription Book.*

THE FIFTEENTH EDITION.

Containing Lists of Terms, Phrases, Contractions, and Abbreviations, used in Prescriptions, with Explanatory Notes, the Grammatical Constructions of Prescriptions, Rules for the Pronunciation of Pharmaceutical Terms, A Prosodiacal Vocabulary of the Names of Drugs, &c.; and a series of Abbreviated Prescriptions illustrating the use of the preceding terms, &c.; to which is added a Key, containing the Prescriptions in an unabbreviated form, with a Literal Translation, intended for the use of Medical and Pharmaceutical Students. By JONATHAN PEREIRA, M.D., F.R.S., &c.

Price, in Cloth, \$1.25; in Tucks, with pocket, \$1.50

"Although intended chiefly for the Medical practitioner and student, it will be found exceedingly convenient and useful for the Apothecary. There are many points of usefulness and interest in the book which claims for it a place in the Library of every pharmaceutical student."—*American Journal of Pharmacy.*

## *Wythes's Physician's Pocket Dose and Symptom Book.* THE TENTH EDITION, REVISED.

Containing the Doses and Uses of all the Principal Articles of the Materia Medica, and Original Preparations; A Table of Weights and Measures, Rules to Proportion the Doses of Medicines, Common Abbreviations used in writing Prescriptions, Table of Poisons and Antidotes, Classification of the Materia Medica, Dietetic Preparations, Table of Symptomatology, Outlines of General Pathology and Therapeutics, &c. By JOSEPH H. WYTHES, A.M., M.D., &c.

Price, in cloth, \$1.25; in tucks, \$1.50

This little manual has been received with much favor, and a large number of copies sold. It was compiled for the assistance of students, and to furnish a vade-mecum for the general practitioner, which would save the trouble of reference to larger and more elaborate works. The present edition has undergone a careful revision. The therapeutical arrangement of the Materia Medica has been added to it, together with such other improvements as it was thought might prove of value to the work.

## *Pulmonary Consumption; Its Nature, Varieties, and Treatment.*

With an Analysis of One Thousand Cases to exemplify its duration. By C. J. B. WILLIAMS, M.D., F.R.S., Senior Consulting Physician to the Hospital for Consumption, and CHARLES THEODORE WILLIAMS, M.D., Physician to the Hospital for Consumption, &c. Price, . . . \$3.50

## *Prince's Plastic and Orthopedic Surgery.* Containing

PART I. A Report on the Condition of, and Advances made in, Plastic and Orthopedic Surgery, up to the Year 1871. PART II. A New Classification and Brief Exposition of Plastic Surgery. With numerous illustrations. PART III. ORTHOPEDICS: A Systematic Work upon the Prevention and Cure of Deformities. With numerous Illustrations. Octavo. Price, \$4.50

## *Lindsay & Blakiston's Physician's Visiting List* for 1872. SIZES AND PRICE.

For 25 Patients weekly.	Tucks, pockets, and pencil,	. . . . .	\$1.00
50 " " " " " "	" " " " " "	. . . . .	1.25
75 " " " " " "	" " " " " "	. . . . .	1.50
100 " " " " " "	" " " " " "	. . . . .	2.00
50 " " 2 vols.,	{ Jan. to June. }	{ July to Dec. }	" . . . . . 2.50
	{ July to Dec. }		
100 " " 2 vols.,	{ Jan. to June. }	{ July to Dec. }	" . . . . . 3.00
	{ July to Dec. }		

### THE INTERLEAVED EDITION.

For 25 Patients weekly, interleaved, tucks, pockets, &c.,	. . . . .	\$1.50
50 " " " " " "	. . . . .	1.75
50 " " 2 vols.,	{ Jan. to June. }	{ July to Dec. }
	{ July to Dec. }	
	" "	. . . . . 3.00

*Rihl & O'Conner's Physician's Diary*, Monthly, Semi-Annual, and Annual Journal and Cash-Book Combined. The Fourth Revised Edition. A large folio volume, with Printed Heads, Index, &c., &c. Bound in full leather. Price, . . . . . \$7.50

## *Harris's Principles and Practice of Dentistry.*

### THE TENTH REVISED EDITION.

In great part rewritten, rearranged, and with many new Illustrations. Revised and edited by P. H. AUSTEN, M.D., Professor of Dental Science and Mechanism in the Baltimore College of Dental Surgery, assisted by Prof. GORGAS and THOS. S. LATIMER, M.D. With 400 Illustrations.

Price, in Cloth, \$6.50; in Leather, 7.50

## *Meadows's Manual of Midwifery.* A NEW TEXT-BOOK.

Including the Signs and Symptoms of Pregnancy, Obstetric Operations, Diseases of the Puerperal State, &c., &c. By ALFRED MEADOWS, M.D., Member of the Royal College of Physicians, &c., &c. First American from the Second London Edition, with numerous Illustrations. Price, . . \$3.00

*Dillnberger's Handy-Book of the Treatment of Women and Children's Diseases*, according to the Vienna Medical School. Translated from the Second German Edition, by P. NICOL, M.D. Price, . . . . . \$1.75

## *Byford on the Uterus.* SECOND EDITION.

On the Chronic Inflammation and Displacements of the Unimpregnated Uterus. By W. A. BYFORD, A.M., M.D., Professor of Obstetrics, and Diseases of Women, in Chicago Medical College; and author of "The Practice of Medicine and Surgery, Applied to the Diseases of Women." A New, Enlarged, and thoroughly Revised Edition, with numerous Illustrations. One volume, Octavo. Price . . . . . \$2.00



## *Tanner and Meadows's Practical Treatise on the Diseases of Infancy and Childhood.*

By THOMAS HAWKES TANNER, M.D. The Third American from the last London Edition, by ALFRED MEADOWS, M.D., author of "A Manual of Midwifery," &c., &c. One volume. Price, . . . . . \$3.50

## *Tilt's Change of Life in Health and Disease.*

A Practical Treatise on the Nervous and other Affections incidental to Women at the Decline of Life. By EDWARD JOHN TILT, M.D. From the Third London Edition. In one volume Octavo. Price, . . \$3.00

## *Duchenne's Localized Electrization.*

Translated from the Third Edition, by HERBERT TIBBITTS, M.D., L.R.C.P. Lond., Medical Superintendent of the National Hospital for the Paralyzed and Epileptic. With 92 Illustrations, and Notes and Additions by the Translator. Price, . . . . . \$3.00

## *Wright on Headaches.* A NEW EDITION.

Their Causes and Their Cure. By HENRY G. WRIGHT, M.D., Member of the Royal College of Physicians, &c., &c. From the Fourth London Edition. Price, . . . . . \$1.25

## *Reynolds's Lectures on the Clinical Uses of Electricity.*

delivered at the University College Hospital, by J. RUSSELL REYNOLDS, M.D., F.R.S., Professor of the Principles and Practice of Medicine, University College, London, editor of "A System of Medicine," &c., &c. One volume, Post Octavo. Price, . . . . . \$1.50

## *Paget's Surgical Pathology.* THIRD LONDON EDITION.

Lectures delivered at the Royal College of Surgeons of England, by JAMES PAGET, F.R.S., Surgeon to Bartholomew and Christ's Hospital, &c., &c. The Third London Edition, Edited and Revised by WILLIAM TURNER, M.B., Lond., Senior Demonstrator of Anatomy in the University of Edinburgh, &c., &c. In one volume, Royal Octavo. With numerous Illustrations. Price, . . . . . \$7.50

"It would be very superfluous for us to say many words in calling the attention of the profession to this new edition of Mr. Paget's great work on Surgical Pathology. Its author has been singularly fortunate in securing the assistance (for this edition) of so able a collaborator as Mr. Turner, and English surgery may point with pride to the present volume as one unsurpassed, if it is at all equalled in the surgical literature of the world, in breadth of view and philosophical grasp of its subject."—*Practitioner*.

## *Beasley's Druggists' Receipt Book.* SEVENTH AM. ED.

Comprising a copious Veterinary Formulary, numerous Receipts of Patent and Proprietary Medicines, Druggists' Nostrums, &c.; Perfumery and Cosmetics, Beverages, Dietetic Articles and Condiments, Trade Chemicals, Scientific Processes, and an Appendix of Useful Tables, by HENRY BEASLEY, author of the Book of Prescriptions, &c., &c. Price, . . . \$3.50



# Rindfleisch's Text-Book of Pathological Histology. 208 Illustrations.

*An Introduction to the Study of Pathological Anatomy.* By Dr. EDWARD RINDFLEISCH, O. O. Professor of Pathological Anatomy in Bonn. Translated from the Second German Edition, by WM. C. KLOMAN, M. D., assisted by F. T. MILES, M. D., Professor of Anatomy, University of Maryland, &c., &c.

## CONTENTS.

Introduction, Author's and Editor's Prefaces.

### GENERAL PART.

1. Decomposition and Degeneration of Tissues.
2. Pathological New Formations.

### SPECIAL PART.

- |   |                              |
|---|------------------------------|
| 1. Anomalies of the Blood and the Places of its Formation, especially of the Spleen and Lymphatic Glands. | 9. Anomalies of the Ovaries. |
| 2. Anomalies of the Circulatory Apparatus.  | 10. " " Testicles.           |
| 3. Anomalies of Serous Membranes.   | 11. " " Mammæ.               |
| 4. " the Skin.  | 12. " " Prostate Gland.      |
| 5. " Mucous Membranes.  | 13. " " Salivary Glands.     |
| 6. " the Lung.  | 14. " " Thyroid Gland.       |
| 7. " " Liver.   | 15. " " Suprarenal Capsules. |
| 8. " " Kidney.  | 16. " " Osseous System.      |
|   | 17. " " Nervous System.      |
|   | 18. " " Muscular System.     |

### Index and Bibliography.

Containing 208 Elaborately Executed Microscopical Illustrations.

One volume, octavo. Price, cloth, \$6.00; sheep, \$7.00.

Prof. Rindfleisch's Text-Book of Pathological Histology, so justly celebrated in Germany, where it is considered the most complete and thorough work of its kind, having passed rapidly to a second edition, is also very highly valued and commended by German Medical scholars in this country, many of whom are not only familiar with the book, but with the author's great reputation as a teacher and professor of this branch of medical study.

The translators are both gentlemen who by their past education have been peculiarly fitted for the task of translating the work. Dr. Kroman from early life has been familiar with the German language, while Prof. Miles has made the subject one of special study, both gentlemen being also practical microscopists. The Publishers therefore offer a translation of this truly valuable work to the Medical Profession in the United States, feeling the utmost confidence that in both manner and style it will prove acceptable to them. In their Preface, the Translators say: "In presenting the English reading portion of the Medical Profession with a translation of the valuable work of Prof. Rindfleisch, the translators scarcely deem an apology necessary. The merits of the book itself, and the fact that it fills an unoccupied gap in our most recent literature upon the subject of Pathological Histology, was judged to be an ample incentive for undertaking the labor of the translation. The work of VIRCHOW translated by CHANCE, is, in many points, antiquated, and the more recent work of BILBROTH, translated by HACKLEY, occupies the ground but partially, and is professedly a work of Surgical Pathology."

This book is translated and published in this country by special arrangement with the author.

# *Waring's Practical Therapeutics.* A NEW EDITION.

Considered chiefly with reference to Articles of the *Materia Medica*.

By EDWARD JOHN WARING, F.R.C.S., F.L.S., &c., &c. Second American, from the Third London Edition. Royal Octavo.

Price in Cloth, \$5.00; Leather, 6.00.

There are many features in Dr Waring's *Therapeutics* which render it especially valuable to the Practitioner and Student of Medicine, much important and reliable information being found in it not contained in similar works; it also differs from them in its completeness, the convenience of its arrangement, and the greater prominence given to the medicinal application of the various articles of the *Materia Medica* in the treatment of morbid conditions of the Human Body, &c. It is divided into two parts, the alphabetical arrangement being adopted throughout; there is also added an excellent INDEX OF DISEASES, with a list of the medicines applicable as remedies, and a full INDEX of the medicines and preparations noticed in the work.

"This new edition of *Waring's Practical Therapeutics* has been altered and improved with great judgment. A satisfactory account of new agents—chloral, apomorphia, nitrous oxide, carbolic acid, &c., is introduced without adding to its bulk. The additions are made with remarkable skill in condensation. It is one of the best manuals of therapeutics yet in existence."—*Brit. Med. Journal*.

"There has been no scarcity, latterly, of works of this class, several of them we regard as having great professional value; but, it must be allowed, we think, that this holds no inferior place among them. Still it is a national book, but much more voluminous; and, therefore, while it is high authority, it is less convenient for office use. Furthermore, we prefer the literary arrangement and execution of *Waring*. It can be used with more readiness and always relied on for the correctness of its facts. In the daily treatment of diseases, it seems to supply everything that can be desired. The articles are arranged alphabetically, and a paragraph is devoted to their physical description and scientific character. Their therapeutic uses, however, constitute the bulk of the volume; and in this respect the labor has been very thorough."—*Druggists' Circular*.

"The plan of this work is admirable, and well calculated to meet the wants of the busy practitioner. There is a remarkable amount of information, accompanied with judicious comments, imparted in a concise yet agreeable style. The indications for the application of remedies are sufficiently comprehensive, and their mode of action generally accounted for on rational grounds. The publishers have well performed their part, and we trust that their enterprise in introducing the work to the profession in America may meet with that encouragement which the inherent merits of the treatise itself are entitled to command."—*Medical Record*.

"Our admiration, not only for the immense industry of the author, but also of the great practical value of the volume, increases with every reading or consultation of it. We wish a copy could be put in the hands of every student or practitioner in the country. In our estimation it is the best book of the kind ever written."—*N. Y. Medical Journal*.

"It is, indeed, one of the most practical works that has ever attracted our attention. Combining the merits of Wood, Beck, Still, and the U. S. Dispensatory, it forms a volume which no young physician can afford to be without."—*Chicago Medical Journal*.

"This work is a monument of industry and perseverance, invaluable both to the Practitioner and Student."—*Canada Medical Journal*.

"Mr. Waring has produced a volume which entitles him to the thanks of Students as well as of all who need a work on Therapeutics."—*American Medical Journal*.

"A more laborious, painstaking, and valuable composition does not exist in any other language on the subject: one that should be in every practicing Physician and Surgeon's study, without which their libraries, no matter how rich otherwise in works on *Materia Medica*, must of necessity be incomplete."—*Dublin Quarterly Journal of Medicine*.

"No work on this subject has appeared that can be more fully recommended to the Student and Physician. It not only contains all that is actually necessary to the Practitioner, but affords otherwise, much useful, valuable, and novel instruction. The oldest Physician and the most accurate Student will find in it much that has not, and cannot be seen elsewhere. No one can consult its pages without receiving practical information and judicious counsel."—*Richmond Medical Journal*.

# POPULAR TEXT-BOOKS,

Published by LINDSAY & BLAKISTON.

- CAZEAUX'S Text-Book of Obstetrics.**—Fifth American Edition. Illustrated.  
**WARING'S Practical Therapeutics.**—From the Third London Edition.  
**RINDFLEISCH'S Text-Book of Pathological Histology.**—Illustrated.  
**AITKEN'S Science and Practice of Medicine.** 2 volumes. Illustrated.  
**TANNER'S Practice of Medicine.**—Fifth American from the Sixth London Edition.  
**MEIGS & PEPPER'S Practical Treatise on the Diseases of Children.**—Fourth Ed.  
**TANNER & MEADOW'S Diseases of Infancy and Childhood.**—Third American Ed.  
**BIDDLE'S Materia Medica, for Students.** Fourth Edition. With Illustrations.  
**GANT'S Science and Practice of Surgery.**—470 Illustrations.  
**HARRIS'S Principles and Practice of Dentistry.**—The Tenth Revised Edition  
**PAGET'S Surgical Pathology.**—By Turner. Third London Edition  
**SOELBERG WELLS on Diseases of the Eye.**—Second London Edition.  
**BYFORD'S Practice of Medicine and Surgery, applied to the Diseases of Women.**—Second Edition. Illustrated.  
**HEWITT'S Diagnosis and Treatment of the Diseases of Women.**—Second Edition.  
**HEADLAND on the Action of Medicines.**—Sixth American Edition.  
**BEALE'S How to Work with the Microscope.**—Fourth Edition.  
**KIRKE'S Handbook on Physiology.**—The Seventh London Edition.

## MANUALS FOR STUDENTS.

- MEADOW'S Manual of Midwifery, Including the Signs and Symptoms of Pregnancy, Obstetric Operations, &c.** From the Second London Edition.  
**LAWSON'S Diseases and Injuries of the Eye, their Medical and Surgical Treatment.**  
**CHEW'S Lectures on Medical Education.**  
**MENDENHALL'S Medical Student's Vade Mecum.**—The Tenth Edition. 224 Illustrations.  
**ROBERTSON'S Manual for Extracting Teeth.**—Second Edition. Revised.  
**DIXON'S Practical Study of the Diseases of the Eye.**—Third Edition.  
**PEREIRA'S Physician's Prescription Book.**—The Fifteenth Revised Edition.  
**REESE'S Analysis of Physiology.**—Second Edition.  
**WYTHES' Pocket Dose and Symptom Book.** Tenth Edition, with Additions.  
**BARTH & ROGER'S Manual of Auscultation and Percussion.**—Sixth Edition.  
**CLEVELAND'S Pronouncing Medical Lexicon.**—Thirteenth Edition.  
**LEGG'S Guide to the Examination of the Urine.**—Second London Edition.  
**HILL's Pocket Anatomist, for the use of Students.**  
**TANNER'S Memoranda of Poisons.**—From the Second London Edition.

*A complete Descriptive Catalogue of their Publications, together with a classified and priced list of all recent Medical Books, American and English, furnished or mailed free on application.*

LINDSAY & BLAKISTON,

MEDICAL PUBLISHERS AND BOOKSELLERS,

No. 25 South Sixth St., Philadelphia.



THE SCIENCE AND PRACTICE  
OF  
SURGERY.

W0

100

Gs

1871

THE  
SCIENCE AND PRACTICE  
OF  
SURGERY.

Illustrated by Four Hundred and Seventy Wood Engravings.

2649

BY  
FREDERICK JAMES GANT, F.R.C.S.

SURGEON TO THE ROYAL FREE HOSPITAL,  
FORMERLY SURGEON TO HER MAJESTY'S MILITARY HOSPITALS, CRIMEA AND SCUTARI.



PHILADELPHIA:  
LINDSAY AND BLAKISTON.  
1871.



608

33115

13716

LONDON :

SAVILL, EDWARDS AND CO., PRINTERS, CHANDOS STREET,  
COVENT GARDEN.

## PREFACE.

---

It is now many years since a new systematic work representing the Science and Practice of Surgery, has appeared in this country.

In offering this to the Profession, as the most recent one, I have endeavoured to introduce a full but condensed embodiment of all those changes in the Pathology and Treatment of Injuries and Diseases, which the progress of Surgery has *established*.

The leading features of this work are these:—It is essentially *descriptive*—not theoretical. In describing the various forms of Injury and Disease, I have endeavoured to present a sound and enlarged view of Surgical Pathology; but exhibiting, more particularly, the *guiding elements* of their pathology—whether for the purpose of study or reference. The whole is *uniformly arranged* under three heads—(1) Structural condition, with its Signs or Symptoms, and Diagnosis; (2) Causes, and Effects of the morbid condition; (3) Course, Terminations, Consequences, and Prognosis. The primary importance of all that pertains to the Diagnosis, or detection and discrimination of morbid conditions, has induced me to introduce a brief description of the healthy Anatomy of the part; wherever this seemed necessary or convenient, to clearly understand the nature of the structural alterations in Disease or Injury; or for guidance in Surgical Operations. Thus will be found the Surgical Anatomy of the region or parts concerned, in relation to Herniæ; and, of the Arteries, in connexion with Ligature. Physiology is interwoven with the Pathology of morbid conditions. (4) Treatment is fully considered—the *pathological indications* being stated, with guiding rules of treatment; and their fulfilment, both by medicinal agents—so far as the remedial efficacy of medical treatment may be at present known—and by the appropriate Surgical *Operations* or manipulations,—the design and performance of which are carefully described in detail. The various kinds of Surgical Instruments and *Apparatus* are also specially noticed, and their mode of application explained.

Statistical Results of Treatment, are appended whenever usefully illustrative of the curative value of Surgical Operations.

The range of this work, in respect to its subject-matter, will be seen on perusing the Table of Contents. The Introduction presents a pre-

liminary view of the nature of Surgery, as a Science and an Art ; the latter, principally in regard to Operations, the Conditions favourable or unfavourable for their performance ; the Arrangements necessary as to Instruments and Assistants ; Anæsthetics, especially Chloroform ; the Dangers attending or consequent on Operations, and their Results. Then follows the recognised division of Pathology and Surgery into Two Parts—General, and Special ; and the latter is arranged under Two Divisions—Injuries and Diseases of Textures, and those of Organs and Regions.

Part I.—General Pathology and Surgery, comprising the forms of Disease which are common to all parts of the body, is made more comprehensive than in other systematic works ; it being the source of guidance in all Surgical Practice. This Part relates to Inflammation, Tumours or Morbid Growths, Degenerations, Ulceration and Mortification. Then follow also Diseases of the Blood—as Scrofula, Scurvy and Purpura, Rheumatism and Gout ; Diseases of Contagious Origin—as Syphilis, Erysipelas, Pyæmia, Hospital Gangrene, Poisoned Wounds, Hydrophobia, Malignant Pustule, Glanders ; Diseases of the Nervous System—Shock of Injury, Prostration with Excitement, Tetanus. In Part II.—Special Pathology and Surgery, relating to the Textures, comprises the Injuries and Diseases of the Skin, and subjacent textures, in succession ;—as Wounds, Burns, Cellulitis ; Aneurisms, and Diseases of Arteries ; Fractures, and Diseases of Bone ; Dislocations, and Diseases of Joints ; Deformities ; Excisional Surgery of the Joints and Bones ; Amputations. As relating to Organs and Regions, this Division, beginning with the Head, and proceeding downwards in the body, is made equally comprehensive, so as to include a condensed view of each Special Branch of Surgery. Thus, it embraces, Diseases of the Eye, Ear, and Teeth, which belong respectively to Ophthalmic, Aural, and Dental Departments of Surgical Practice.

The Regional association of morbid conditions is especially calculated to facilitate the study of Diagnosis ; and the arrangement of pathological and surgical knowledge—relative to each form of Injury and Disease, throughout the work, will be found most serviceable as a preparation for the order of Clinical investigation, and record of cases. By constantly having regard to the selection of essential matter, and pursuing the uniform arrangement laid down ; I have thus, also, I trust, simplified, and not inconsiderably abridged the size of this work, as compared with those of similar character. These features will perhaps make it better adapted for the use of Students, as a Surgical Text-book ; while, the wide range of subjects, may render it more completely serviceable to the Practitioner, for reference.

The “ Science and Practice ” is quite independent of the Author’s “ Principles of Surgery,” although the two works have this relation : the one forms a systematic *description* of injuries and diseases, taken in-



*dividually*, in their pathology and treatment; the other is a systematic *exposition* of the guiding doctrines of all diagnosis, etiology, prognosis and therapeutics, from an original analysis of *general* pathology in the different classes of injury and disease. References to the Principles, for the convenience of those readers who have that work, are indicated, in the course of this work, by P. with the page, in brackets; as thus, [P. p. .]

As a general representation of Surgery, many sources of information have necessarily contributed; and it would be almost impossible to name individually, all those to whom by their published writings, I am indebted. The majority are acknowledged in foot-notes, or in the text. Some, whose labours have long since been established in surgical literature, are omitted. Of more recent sources of original information, not hitherto gathered into a work of this kind, I may here more particularly mention my indebtedness to many of the elaborate treatises in "the System of Surgery," by various authors, edited by Mr. T. Holmes. Thus, taking them in alphabetical order, I am under obligation to—Mr. Birkett, on Hernia and on Diseases of the Breast; Dr. Brown-Séquard, on Diseases of the Nerves; Mr. Holmes Coote, on Diseases of the Thyroid Gland; Mr. J. Dixon, on Diseases and Injuries of the Eye; Dr. George Harley, on Apnœa; Mr. E. Hart, on Aneurism; Mr. Charles Hawkins, on Lithotrity; Mr. Prescott Hewett, on Injuries of the Head; Mr. Hinton, on Diseases of the Ear; Mr. T. Holmes, on Aneurism, and on Diseases of the Bones; Mr. T. K. Hornidge, on General Pathology of Fractures; Dr. G. M. Humphry, on Diseases of the Male Organs of Generation; Mr. Jonathan Hutchinson, on Surgical Diseases of Women; Mr. Athol Johnson, on Diseases of the Joints; Mr. H. Lee, on Syphilis; Dr. W. J. Little, on Orthopædic Surgery; Mr. T. Longmore, on Gunshot Wounds; Mr. C. H. Moore, on Cancer; Sir James Paget, on Tumours; Mr. A. Poland, on Urinary Calculi and Lithotomy; Mr. G. D. Pollock, on Diseases of the Mouth and Alimentary Canal; Mr. S. James A. Salter, on Surgical Diseases connected with the Teeth; Mr. W. S. Savory, on Hysteria; Mr. A. Shaw, on Disease of the Spine; Mr. J. Simon, on Inflammation; Mr. Henry Smith, on Diseases of the Rectum; Sir H. Thompson, on the Surgery of the Male Urinary Organs.

I have also had recourse to other standard Treatises, recently published; and notably to—Hamilton, on Fractures and Dislocations; W. Adams, on Subcutaneous Surgery; Mr. R. Barwell, on Lateral Curvature of the Spine; Lockhart Clarke, on Tetanus; John Wood, on Rupture; Mr. Christopher Heath, on Diseases of the Jaws; Mr. Butcher's Operative and Conservative Surgery; Sir William Fergusson's Practical Surgery; Curling, on Diseases of the Testis, and on Diseases of the Rectum.

Many valuable Papers also in the Transactions of the Royal Medico-Chirurgical, and other Societies, have been levied; and Original Com-

munications to the Medical Quarterlies and Weekly Journals. Nor have I hesitated to avail myself of the latest Editions of other Systematic Works on Surgery, already familiar to the Profession—the works of Erichsen, Pirrie, and Druitt; gleaning wherever I could find anything new and important, or specially considered. Lastly, I have to thank several of my Professional brethren for having favoured me with notes on points of experience; and Mr. Hancock, for having kindly placed at my disposal the unpublished MSS. of his valuable Lectures on the Surgery of the Foot and Hip,—as delivered at the Royal College of Surgeons.

My own Pathological observations and Surgical experiences are interspersed throughout the work. Thus, I may be permitted to allude to Reparation in Wounds, Fractures, and after Injury of Arteries and Veins; Acupressure, Ligature, and Torsion of Arteries; the Pathological Conditions of Contused and Lacerated Wounds, of Compound Fractures, and of Compound Dislocations, which severally require Amputation; Dislocation of the Elbow-joint; Tumours; Degenerations; Polypus nasi; the Irritable Bladder; and, Diseases of the Joints, chiefly with reference to Excision,—being the Author's Lettsonian Lectures, on “Excisional Surgery,” as delivered before the Medical Society of London, 1871.

A carefully compiled Index, in conclusion, will be found convenient for reference.

After all my labour I am fully conscious of many shortcomings in my endeavour to do justice to the present state of Surgery; but I must plead the unaided, single-handed production of the work, on a subject so comprehensive, and pursued for years amid the daily interruptions of Professional avocations, public and private.

Of the Wood Engravings, 470 in number, which illustrate, and I trust adorn, the following pages, many are original,—the drawings having been taken from cases which have come under my own observation. Those which relate to Excisional Surgery were drawn by Mr. C. D'Alton, with his well-known accuracy. But, with regard to the larger proportion of the engravings, I am under obligation to my Publishers, Messrs. J. and A. Churchill, who have aided me in the most liberal spirit, with regard to the whole of their large collections of unsurpassed Wood-blocks, which originally illustrated Sir Astley Cooper's “Fractures and Dislocations,” edited by B. Cooper; those in Liston's “Practical Surgery;” and more recently in Fergusson's “Practical Surgery.” Sir William Fergusson himself most readily concurred in this arrangement—an additional kindness to many others—and thus enabled me to enrich this work with a large assortment of instruments and apparatus peculiar to Modern Surgery; and also to illustrate the Operations which he has either devised or modified, and with which the association of his

name is familiar; especially Lithotomy and Lithotrity, Operations for Tumours of the Jaws, and that for Cleft-Palate. My friends, Mr. John Wood, and Mr. William Adams, have equally obliged me in regard to the illustrations of their operations, for the Radical Cure of Hernia, and Subcutaneous Section of the Neck of the Femur. I have, moreover, to thank Mr. Heather Bigg, for having permitted me to select, aided by his own judgment and experience, any number of the wood-blocks I thought fit to use from his well-known Manual on "Orthopraxy." They are chiefly to be found in the Chapter on Deformities.

Under cover, I have taken this opportunity of publishing that which will be useful to all those who may be preparing for Examination at the Royal College of Surgeons of England, and which cannot fail to be interesting to the Profession at large,—a Guide to the Examinations for the Diplomas of Member and Fellow. It was written from personal observation during the last two years (1870-1); and, it exhibits the whole course of Examination in detail;—the nature of the Anatomical and Pathological Preparations, Surgical Instruments and Apparatus, and of the Questions, &c., submitted to Candidates,—in both the "Written" and "Practical," and of the "Primary," and "Pass," Examinations; with also the "Regulations" of the College relating thereto.

F. J. GANT.

*September, 1871.*





# CONTENTS.

## INTRODUCTION.

SURGERY, as a primary division of MEDICINE; as a Science and a Scientific Art. The relative importance of Diagnosis, Etiology, and Prognosis; and their relation, severally, to Treatment. The relative guidance of PATHOLOGICAL ANATOMY and of PATHOLOGY. Also, in the design and performance of Surgical Operations. Comparison of the Continental and English Schools of Surgery.

CONDITIONS Favourable and Unfavourable for Operation. Preparation of Patient. Arrangements for Operation—The Room, Table, Instruments, Assistants. Anæsthetics. Historical notice. Chloroform—its Physiological Action. Phenomena or Symptoms. Contra-indications to the employment of Chloroform, and exceptional Operations. Administration of Chloroform, and signs of anæsthesia. Inhalers. Death from Chloroform—by Asphyxia, Cardiac Syncope, Coma, persistent sickness. Treatment of an overdose. Other Anæsthetics—Nitrous Oxide or Laughing Gas. Sulphuric Ether. Bichloride of Methylene. Chloral. Local Anæsthesia. Freezing—by frigorific mixtures, ether-spray. Dangers attending, or consequent on, Surgical Operations. Dressing of the Wound, and Constitutional After-treatment. Results of Operation—Temporary, Permanent. Modes of Unsuccessful Results.

## PART I.

### GENERAL PATHOLOGY AND SURGERY.

#### DISEASES OF NUTRITION.

##### CHAPTER I.—INFLAMMATION.

	PAGE
NUTRITION . . . . .	20
Inflammation . . . . .	23
Textural Changes, and State of the Circulation and Blood-vessels . . . . .	23

NUTRITION—*continued.*

Signs . . . . .	27
Constitutional Symptoms—Inflammatory Fever . . . . .	31
Causes . . . . .	39
External and Internal . . . . .	39
Exciting and Predisposing . . . . .	39
Course and Terminations . . . . .	41
Resolution . . . . .	41
Effusion and Products . . . . .	42
Suppuration and Abscess . . . . .	52
Ulceration . . . . .	57
Mortification . . . . .	58
Treatment . . . . .	60
Local . . . . .	62
Constitutional . . . . .	65
Varieties of Inflammation . . . . .	79

## CHAPTER II.—TUMOURS OR MORBID GROWTHS.

General Pathology, and Treatment . . . . .	81
Special Tumours . . . . .	83
Cysts and Cystic Tumours . . . . .	84
Fatty Tumour . . . . .	90
Fibro-cellular Tumour . . . . .	92
Painful Subcutaneous Tubercle . . . . .	94
Fibrous Tumour . . . . .	95
Recurring Fibroid, and Fibro-nucleated Tumours . . . . .	96
Cartilaginous Tumour—Enchondroma . . . . .	97
Myeloid Tumour . . . . .	99
Vascular or Erectile Tumour . . . . .	100
Nævus . . . . .	103
Aneurism by Anastomosis . . . . .	105
Osseous and Glandular Tumours . . . . .	105
Infiltrating Growths—Cancer . . . . .	105
Encephaloid. Scirrhus. Colloid . . . . .	106
Varieties . . . . .	109
Cyst Formation . . . . .	111
Origin and Causes . . . . .	114
Course . . . . .	117
Terminations . . . . .	118
Recurrence, and Secondary Cancer . . . . .	119
Treatment . . . . .	121
Operations . . . . .	123
Epithelial Cancer . . . . .	126

## CHAPTER III.—DEGENERATIONS.

General Pathology and Treatment . . . . .	132
Special Degenerations . . . . .	133



# CHAPTER IV.—ULCERATION AND ULCERS, GANGRENE AND MORTIFICATION.

Ulceration . . . . .	134
Healthy Ulcer . . . . .	135
Inflamed Ulcer . . . . .	136
Irritable Ulcer . . . . .	136
Œdematous Ulcer . . . . .	137
Indolent and Varicose Ulcer . . . . .	137
Phagedænic Ulcer . . . . .	139
Hæmorrhagic Ulcer . . . . .	139
Scorbutic Ulcer . . . . .	139
Scrofulous or Strumous Ulcer . . . . .	140
Cancerous Ulcer . . . . .	141
Lupoid Ulcer . . . . .	141
Syphilitic Ulcer . . . . .	141
Gangrene and Mortification . . . . .	142
Causes . . . . .	143
Fever . . . . .	148
Treatment . . . . .	149
Amputation . . . . .	151

## DISEASES OF THE BLOOD.

### CHAPTER V.—SCROFULA.

General Symptoms . . . . .	153
Special Forms . . . . .	153
Causes . . . . .	159
Treatment . . . . .	160
Scurvy and Purpura . . . . .	162

### CHAPTER VI.—RHEUMATISM AND GOUT.

Rheumatism . . . . .	165
Symptoms and Diagnosis . . . . .	165
Treatment . . . . .	167
Gout . . . . .	168
Symptoms and Diagnosis . . . . .	168
Treatment . . . . .	171

## DISEASES OF CONTAGIOUS ORIGIN.

### CHAPTER VII.—SYPHILIS.

Local Syphilis . . . . .	173
Chancre, and its Diagnosis . . . . .	173
Bubo, and its Diagnosis . . . . .	176
Constitutional or Secondary Syphilis . . . . .	180
Skin Diseases . . . . .	181
Roseola . . . . .	181
Lichen . . . . .	181
Tubercular eruption . . . . .	182

SYPHILIS—*continued*.

Lepa	182
Psoriasis	182
Vesicular Eruptions	182
Pustular Eruptions	182
Ulceration of the Skin	183
Diseases of Mucous Membranes	183
Ulceration of Tonsils	183
Syphilitic Iritis	185
Chronic Enlargement of Testicle	185
Diseases of Bones, and Periosteum	186
Tertiary Symptoms	187
Hereditary, Congenital, Infantile Syphilis	187
Vaccino-Syphilitic Inoculation	189
Unity or Duality of Syphilitic Virus	191
Treatment	192
Local Syphilis	192
Constitutional Syphilis	193
Syphilization	198

## CHAPTER VIII.—ERYSIPELAS.

Simple Erysipelas	200
Phlegmonous Erysipelas	201
Causes	205
Treatment	206

## CHAPTER IX.—PYÆMIA OR PURULENT INFECTION.

Symptoms	209
Secondary Abscesses	209
Pathology	210
Exciting Causes	215
Treatment	216

## CHAPTER X.—HOSPITAL GANGRENE.

Signs	216
Origin and Course	217
Causes	221
Treatment	222

## CHAPTER XI.—POISONED WOUNDS.

Hydrophobia	223
Treatment	226
Snake-bites	228
Treatment	229
Malignant Pustule—Charbon.	229
Treatment	230
Glanders	230
Treatment	230

## DISEASES OF THE NERVOUS SYSTEM.

	PAGE
CHAPTER XII.—SHOCK OF INJURY. COLLAPSE.	
Symptoms and Diagnosis . . . . .	232
Causes . . . . .	232
Terminations . . . . .	233
Treatment . . . . .	234
Prostration with Excitement . . . . .	235
CHAPTER XIII.—TETANUS.	
Symptoms and Diagnosis . . . . .	236
Varieties . . . . .	237
Pathology . . . . .	238
Causes . . . . .	240
Course, and Terminations . . . . .	241
Treatment . . . . .	241

## PART II.

## SPECIAL PATHOLOGY AND SURGERY.

## DIVISION I.

## INJURIES AND DISEASES OF TEXTURES.

## SKIN AND SUBJACENT TEXTURES.

CHAPTER XIV.—WOUNDS—INCISED WOUND, WOUNDS OF  
ARTERIES AND VEINS.

Incised Wound . . . . .	243
Reparation . . . . .	244
Immediate Union . . . . .	245
Primary Adhesion . . . . .	245
Suppurative Granulation and Cicatrization . . . . .	246
Healing under a Scab . . . . .	246
Modelling Process . . . . .	247
Treatment . . . . .	248
Antiseptic Dressings . . . . .	251
Theory of Antisepticism . . . . .	253
Results . . . . .	254
Wounds of Arteries . . . . .	255
Reparation . . . . .	256
Treatment . . . . .	258
Compression . . . . .	259
Ligature . . . . .	259
Acupressure . . . . .	261
Torsion . . . . .	264

WOUNDS—*continued*.

Wounds of Veins . . . . .	266
Entrance of Air into Veins . . . . .	267

CHAPTER XV.—CONTUSION—CONTUSED AND LACERATED WOUNDS—  
PUNCTURED WOUNDS.

Contusion . . . . .	268
Treatment . . . . .	270
Contused and Lacerated Wounds . . . . .	270
Treatment . . . . .	274
Amputation . . . . .	275
Punctured Wounds . . . . .	276
Treatment . . . . .	278

## CHAPTER XVI.—GUNSHOT WOUNDS.

Structural Conditions . . . . .	278
Projectiles . . . . .	282
Consequences . . . . .	284
Prognosis . . . . .	285
Treatment . . . . .	285
Amputation . . . . .	288
Excision . . . . .	289

## CHAPTER XVII.—MORBID CICATRICES.

Deficient Cicatrix. . . . .	289
Excessive, and Exuberant—Cheloid Cicatrix . . . . .	290
Painful Cicatrix . . . . .	291
Ulceration—Growths and Degenerations of Cicatrix . . . . .	291

## CHAPTER XVIII.—BURNS AND SCALDS. LIGHTNING. FROST-BITE.

Burns and Scalds . . . . .	292
Course and Terminations. . . . .	294
Treatment . . . . .	297
Lightning . . . . .	299
Frost-bite . . . . .	300

## CHAPTER XIX.—CELLULITIS. CARBUNCLE, AND BOILS.

Cellulitis . . . . .	301
Symptoms and Diagnosis. . . . .	301
Treatment . . . . .	302
Carbuncle or Anthrax . . . . .	302
Treatment . . . . .	303
Boil or Furunculus . . . . .	304
Chilblain . . . . .	305
Whitlow or Paronychia . . . . .	305
Onychia . . . . .	307
In-grown Toe-nail . . . . .	307
Corns. Horns. Warts . . . . .	308



## MUSCLES AND TENDONS.

CHAPTER XX.—SPRAIN. RUPTURE. TUMOURS.	PAGE
Sprains or Strains . . . . .	309
Rupture of Muscle and Tendon . . . . .	309
Reparation . . . . .	310
Treatment . . . . .	311
Displacement of Tendon . . . . .	312
Inflammation of Muscle . . . . .	312
Tumours . . . . .	313

## BURSÆ AND SHEATHS OF TENDONS.

CHAPTER XXI.—INFLAMMATION. GANGLION.	
Inflammation of Bursæ . . . . .	314
Of Bursæ Patellæ . . . . .	315
Bunion . . . . .	315
Tenosynovitis . . . . .	316
Ganglion . . . . .	317

## NERVES.

CHAPTER XXII.—INJURIES. NEURITIS. NEURALGIA.	
Injuries . . . . .	318
Neuritis . . . . .	318
Neuralgia . . . . .	319

## ARTERIES.

CHAPTER XXIII.—ANEURISM.	
Structural Conditions . . . . .	321
Circumscribed—True Aneurism . . . . .	321
Diffused—False Aneurism . . . . .	321
Fusiform or Tubular Aneurism . . . . .	321
Signs . . . . .	322
Diagnosis . . . . .	323
Causes . . . . .	323
Course and Terminations . . . . .	325
Spontaneous Cure . . . . .	325
Treatment . . . . .	328
Compression . . . . .	329
Ligature . . . . .	332
Manipulation . . . . .	339
Galvano-puncture . . . . .	340
Injection . . . . .	341
Treatment of Traumatic Aneurism . . . . .	342
Aneurismal Varix and Varicose Aneurism . . . . .	343
Signs . . . . .	344
Causes . . . . .	345
Treatment . . . . .	345

## CHAPTER XXIV.—ANEURISM OF SPECIAL ARTERIES.

Arch of Aorta . . . . .	347
Aneurisms at Root of Neck . . . . .	349
Treatment . . . . .	351
Innominate Aneurism . . . . .	351
Aneurisms of Right Carotid and Subclavian Arteries . . . . .	352
Carotid Aneurism . . . . .	352
Subclavian Aneurism . . . . .	353
Aneurism of Carotid Artery . . . . .	353
Wounds and Traumatic Aneurism . . . . .	355
Aneurismal Varix . . . . .	355
Aneurism of Internal Carotid . . . . .	355
Extra-cranial . . . . .	355
Intra-cranial . . . . .	355
Wounds, and Traumatic Aneurism of Internal or	
External Carotids . . . . .	358
Aneurism of Subclavian Artery . . . . .	358
Wounds and Traumatic Aneurism . . . . .	359
Aneurismal Varix . . . . .	359
Aneurism of Axillary Artery . . . . .	359
Wounds and Traumatic Aneurism . . . . .	360
Aneurisms of Brachial, Radial, and Ulnar Arteries . . . . .	360
Wounds and Traumatic Aneurism . . . . .	361
Aneurismal Varix, and Varicose Aneurism . . . . .	361
Aneurism of Abdominal Aorta . . . . .	362
Aneurisms of Iliac Arteries—Common, Internal, and	
External . . . . .	362
Aneurisms of Gluteal, Sciatic, and Pudic Arteries . . . . .	363
Wounds, and Traumatic Aneurism of Gluteal Artery . . . . .	363
Aneurism of Common Femoral Artery . . . . .	364
Wounds and Traumatic Aneurism . . . . .	365
Aneurismal Varix, and Varicose Aneurism . . . . .	365
Aneurism of Femoral Artery—Deep and Superficial	
Femorals . . . . .	365
Wounds and Traumatic Aneurism . . . . .	366
Aneurismal Varix, and Varicose Aneurism . . . . .	367
Aneurism of Popliteal Artery . . . . .	367
Wounds and Traumatic Aneurism . . . . .	369
Aneurisms of Tibial Arteries—Anterior and Posterior . . . . .	369
Aneurismal Varix, and Varicose Aneurism . . . . .	370

## CHAPTER XXV.—LIGATURE OF ARTERIES.

Ligature of an Artery in its continuity . . . . .	370
Ligature of an Artery at the seat of Wound . . . . .	372
Ligature of Innominate Artery . . . . .	372

LIGATURE OF ARTERIES—*continued.*

Surgical Anatomy . . . . .	372
Operation . . . . .	373
Ligature of the Common Carotid Artery . . . . .	374
Surgical Anatomy . . . . .	374
Operation . . . . .	375
Ligature of the External and Internal Carotid Arteries . . . . .	375
Surgical Anatomy . . . . .	375
Operation . . . . .	376
Ligature of the Surgical Artery . . . . .	376
Surgical Anatomy . . . . .	376
Operation . . . . .	377
Ligature of the Subclavian Artery . . . . .	377
Surgical Anatomy . . . . .	377
Operation . . . . .	379
Ligature of the Axillary Artery . . . . .	380
Surgical Anatomy . . . . .	380
Operation . . . . .	382
Ligature of the Brachial Artery . . . . .	382
Surgical Anatomy . . . . .	382
Operation . . . . .	384
Ligature of the Radial Artery . . . . .	384
Surgical Anatomy . . . . .	384
Operation . . . . .	385
Ligature of the Ulnar Artery . . . . .	385
Surgical Anatomy . . . . .	385
Operation . . . . .	386
Ligature of the Abdominal Aorta, and of Iliac Arteries—	
Common, External, and Internal . . . . .	386
Surgical Anatomy . . . . .	386
Operation—External Iliac . . . . .	388
„ Internal Iliac . . . . .	389
„ Common Iliac . . . . .	389
„ Abdominal Aorta . . . . .	389
Ligature of the Femoral Artery—Common and Superficial . . . . .	389
Surgical Anatomy . . . . .	389
Operation—Common Femoral Artery . . . . .	392
„ Superficial Femoral Artery . . . . .	392
Ligature of the Popliteal Artery . . . . .	393
Surgical Anatomy . . . . .	393
Operation . . . . .	394
Ligature of the Anterior Tibial Artery . . . . .	395
Surgical Anatomy . . . . .	395
Operation . . . . .	396
Ligature of the Posterior Tibial Artery . . . . .	397

LIGATURE OF ARTERIES—*continued.*

Surgical Anatomy . . . . .	397
Operation . . . . .	397
Peroneal Artery . . . . .	399

## CHAPTER XXVI.—DISEASES OF ARTERIES.

Arteritis . . . . .	399
Ossification . . . . .	400
Senile Gangrene . . . . .	401

## VEINS.

## CHAPTER XXVII.—INJURIES, VARICOSE VEINS, PHLEBITIS.

Varicose Veins or Varix . . . . .	403
Phlebitis . . . . .	407
Phlebolithes or Vein-Stones . . . . .	408

## LYMPHATICS AND GLANDS.

## CHAPTER XXVIII.—LYMPHATITIS. TUMOURS.

Lymphatitis—Inflammation of the Lymphatics . . . . .	409
Adenitis—Inflammation of Lymphatic Glands . . . . .	410
Enlargements and Tumours . . . . .	411

## BONES.

## CHAPTER XXIX.—FRACTURE.

Fractures . . . . .	411
Signs . . . . .	413
Diagnosis . . . . .	414
Causes . . . . .	414
Reparation . . . . .	415
Treatment . . . . .	417
Compound Fracture . . . . .	424
Treatment . . . . .	425
Amputation . . . . .	427
Complicated Fracture . . . . .	431
Treatment . . . . .	431
Diseased Callus, and Deformed Union . . . . .	432
Treatment . . . . .	433
Ununited Fracture, and False Joint. Disunited Fracture . . . . .	433
Treatment . . . . .	437

## CHAPTER XXX.—SPECIAL FRACTURES.

Fractures of the Facial Bones . . . . .	441
"    "    Nasal Bones . . . . .	441
"    "    Malar Bone . . . . .	442
"    "    Zygoma . . . . .	442
"    "    Upper Jaw . . . . .	442
"    "    Lower Jaw . . . . .	443



SPECIAL FRACTURES—*continued.*

Fractures of the Hyoid Bone . . . . .	443
"    "    Ribs, and Costal Cartilages . . . . .	444
"    "    Sternum . . . . .	446
"    "    Clavicle . . . . .	446
"    "    Scapula . . . . .	449
"    "    Humerus . . . . .	452
"    "    Ulna . . . . .	457
"    "    Radius and Ulna . . . . .	460
"    "    Radius . . . . .	461
"    "    Carpal, Metacarpal Bones, and Fingers . . . . .	463
"    "    Innominate Bones . . . . .	463
"    "    Sacrum . . . . .	465
"    "    Coccyx . . . . .	466
"    "    Femur . . . . .	466
"    "    Patella . . . . .	474
"    "    Tibia . . . . .	478
"    "    Fibula . . . . .	478
"    "    Tarsal, Metatarsal Bones, and Toes . . . . .	483

## CHAPTER XXXI.—DISEASES OF BONE.

Ostitis, or Inflammation of Bone . . . . .	484
Scrofulous Ostitis . . . . .	485
Syphilitic Ostitis . . . . .	485
Periostitis . . . . .	485
Endostitis . . . . .	486
Suppuration . . . . .	487
Osteo-myelitis . . . . .	487
Diffuse Periostitis . . . . .	488
Circumscribed Abscess of Bone . . . . .	489
Caries . . . . .	490
Necrosis . . . . .	493
Rachitis or Rickets . . . . .	497
Mollities Ossium . . . . .	498
Fragilitas Ossium . . . . .	500
Tumours . . . . .	500
Exostosis . . . . .	500
Enchondroma . . . . .	501
Fibrous Tumour . . . . .	501
Cysts . . . . .	501
Cystic Tumours . . . . .	502
Hydatid Cysts . . . . .	502
Cancer—Interstitial . . . . .	503
"    Periosteal . . . . .	503
Pulsatile Tumour, and Osteo-Aneurism . . . . .	505
Diseases of Particular Bones . . . . .	505

## JOINTS.

	PAGE
CHAPTER XXXII.—INJURIES. SPRAINS. WOUNDS. DISLOCATIONS.	
Sprains or Strains . . . . .	506
Wounds . . . . .	506
Dislocations . . . . .	508
Signs . . . . .	508
Diagnosis . . . . .	509
Causes . . . . .	510
Reparation . . . . .	510
Treatment . . . . .	512
Compound Dislocation . . . . .	518
Treatment . . . . .	519
Amputation . . . . .	520
Complicated Dislocation . . . . .	521
Treatment . . . . .	522
Unreduced Dislocation and False Joint . . . . .	522
Treatment . . . . .	524
Congenital Dislocations . . . . .	526
CHAPTER XXXIII.—SPECIAL DISLOCATIONS.	
Dislocations of the Lower Jaw . . . . .	527
"     "     Spine . . . . .	529
"     "     Clavicle . . . . .	529
"     "     Scapula . . . . .	532
"     "     Shoulder-joint . . . . .	532
"     "     Sub-glenoid . . . . .	532
"     "     Sub-clavicular . . . . .	533
"     "     Sub-spinous . . . . .	533
"     "     Elbow-joint . . . . .	538
Radius and Ulna . . . . .	538
Ulna . . . . .	540
Radius . . . . .	541
"     "     Inferior Radio-Ulnar Articulation . . . . .	545
"     "     Radio-carpal Articulation . . . . .	546
"     "     Carpal Bones . . . . .	547
"     "     Metacarpal Bones . . . . .	548
"     "     Phalangeal Bones . . . . .	548
"     "     Pelvis . . . . .	550
"     "     Hip-joint . . . . .	551
On the Dorsum Ilii . . . . .	551
Into Great Ischiatic Notch . . . . .	551
Into Obturator Foramen . . . . .	556
Upon the Pubes . . . . .	558
Anomalous Dislocations . . . . .	559
"     "     Patella . . . . .	560
"     "     Knee-joint . . . . .	562

SPECIAL DISLOCATIONS—*continued*.

Dislocations of the Fibula . . . . .	566
"    "    Ankle-joint . . . . .	566
"    "    Astragalus . . . . .	569
"    "    other Tarsal Bones . . . . .	570
"    "    Metatarsal Bones . . . . .	571
"    "    Phalangeal Bones . . . . .	572

## CHAPTER XXXIV.—DISEASES OF JOINTS.

Synovitis . . . . .	572
Chronic Rheumatic Synovitis or Arthritis . . . . .	575
Scrofulous Synovitis . . . . .	577
Scrofulous Disease or Caries . . . . .	579
Ulceration of Articular Cartilages . . . . .	582
Anchylosis, or Stiff Joint . . . . .	584
Loose Cartilages . . . . .	586
Tumours . . . . .	587
Neuralgia . . . . .	588

## CHAPTER XXXV.—DISEASES OF PARTICULAR JOINTS.

Diseases of the Hip-joint . . . . .	588
Scrofulous Disease—Morbus Coxarius . . . . .	588
Chronic Rheumatic Arthritis—Morbus Coxæ Senilis . . . . .	592
Neuralgia . . . . .	592
Disease of the Sacro-iliac Joint . . . . .	592

## CHAPTER XXXVI.—DEFORMITIES.

Deformities of Face and Neck . . . . .	594
Wry-neck or Torticollis . . . . .	594
Strabismus or Squint . . . . .	596
Deformities of the Arm and Hand . . . . .	597
Deformities of the Leg . . . . .	598
Knock-knee . . . . .	598
Bowed or Bandied Legs . . . . .	599
Contraction of Knee-joint . . . . .	599
Talipes or Club-foot . . . . .	600
Talipes Equinus . . . . .	601
Talipes Varus . . . . .	602
Talipes Valgus . . . . .	604
Flat or Splay Foot . . . . .	604
Talipes Calcaneus . . . . .	605
Varieties of Club-foot . . . . .	605

CHAPTER XXXVII.—EXCISIONAL<sup>m</sup> SURGERY OF THE JOINTS  
AND BONES.

Of the Joints, for Disease . . . . .	606
Joint Excision, and the General Treatment of Joint- Disease . . . . .	607

EXCISIONAL SURGERY OF THE JOINTS—*continued.*

General Conditions of Disease for Excision . . . . .	608
Operation of Joint Excision . . . . .	610
Instruments, and General Directions . . . . .	610
After-treatment . . . . .	611
Repair after Excision . . . . .	613
Excision compared with Amputation . . . . .	613
"    "    "    Natural Cure by Anchylosis . . . . .	614
General Results . . . . .	614
Special Joints . . . . .	615
Knee-joint—Conditions for Excision . . . . .	615
Operation . . . . .	616
After-treatment . . . . .	619
Results—in relation to Natural Anchylosis . . . . .	620
"    "    Mortality . . . . .	620
Statistics, British and Foreign . . . . .	621
Hospitals of England and Scotland (Author's Collection) . . . . .	621
Compared with Amputation in the Thigh . . . . .	622
State of the Limb . . . . .	622
Re-excision . . . . .	624
Secondary Amputation . . . . .	624
Typical Cases of Knee-joint Excision (by Author) . . . . .	625
Analysis of the Cases . . . . .	629
Hip-joint—Conditions for Excision . . . . .	631
Operation . . . . .	634
After-treatment . . . . .	635
Results in relation to Mortality . . . . .	636
Statistics, British and Foreign . . . . .	637
Hospitals of England and Scotland (Author's Collection) . . . . .	638
Compared with Hip-joint Amputation . . . . .	639
State of the Limb . . . . .	639
Section of Neck of Femur . . . . .	639
Typical Cases of Hip-joint Excision (by Author) . . . . .	641
Analysis of the Cases . . . . .	642
Ankle-joint—Conditions for Excision . . . . .	643
Operation . . . . .	644
After-treatment . . . . .	644
Results in relation to Mortality . . . . .	645
Statistics, British . . . . .	645
Hospitals of England and Scotland (Author's Collection) . . . . .	645
Compared with Amputation of the Leg . . . . .	645
"    "    at Ankle-joint (Syme's) . . . . .	646
"    "    (Pirogoff's) . . . . .	646



EXCISIONAL SURGERY OF THE JOINTS—*continued.*

PAGE

State of the Foot . . . . .	646
Secondary Amputation . . . . .	646
Tarsal Bones—Conditions for Excision . . . . .	646
Excision of Astragalus . . . . .	647
Results . . . . .	647
Excision of Os Calcis . . . . .	647
Results . . . . .	648
Compared with sub-astragaloid Amputation . . . . .	649
Excisions of Cuboid, Scaphoid, and Cuneiform Bones . . . . .	649
Excision of Metatarsal Bones and Toes . . . . .	649
Elbow-joint—Conditions for Excision . . . . .	650
Operation . . . . .	651
After-treatment . . . . .	652
Results in relation to Mortality . . . . .	652
Statistics, British and Foreign . . . . .	653
Hospitals of England and Scotland (Author's Collection) . . . . .	653
Compared with Amputation of the Arm . . . . .	653
State of the Limb . . . . .	653
Re-excision . . . . .	655
Secondary Amputation . . . . .	655
Typical Cases of Elbow-joint Excision (by Author) . . . . .	655
Shoulder-joint—Conditions for Excision . . . . .	656
Operation . . . . .	656
After-treatment . . . . .	657
Results in relation to Mortality . . . . .	657
Statistics, British and Foreign . . . . .	657
Hospitals of England and Scotland (Author's Collection) . . . . .	657
State of the Limb . . . . .	658
Wrist—Conditions for Excision . . . . .	660
Operations . . . . .	661
Lister's Operation . . . . .	663
After-treatment . . . . .	665
Results in relation to Mortality . . . . .	666
Hospitals of England and Scotland (Author's Collection) . . . . .	666
Hand—Metacarpal, and Phalangeal Bones . . . . .	667

## EXCISION OF THE JOINTS FOR INJURY.

Knee-joint—Conditions for Excision . . . . .	667
Operation . . . . .	667
After-treatment . . . . .	668
Results in relation to Mortality . . . . .	668

EXCISIONAL SURGERY OF THE JOINTS—*continued.*

Hospitals of England and Scotland (Author's Collection) . . . . .	669
Hip-joint—Conditions for Excision . . . . .	669
Operation, and After-treatment . . . . .	670
Results in relation to Mortality . . . . .	670
Ankle-joint—Conditions for Excision . . . . .	671
Operation, and After-treatment . . . . .	671
Results in relation to Mortality . . . . .	671
Hospitals of England and Scotland (Author's Collection) . . . . .	671
Compared with Amputation of the Leg . . . . .	671
State of the Foot . . . . .	671
Shoulder-joint—Conditions for Excision . . . . .	672
Operation and After-treatment . . . . .	672
Results in relation to Mortality . . . . .	672
„ compared with Secondary Excision . . . . .	672
„ „ with Natural Cure . . . . .	673
„ „ with Amputation at Shoulder-joint . . . . .	673
„ Hospitals of England and Scotland (Author's Collection) . . . . .	673
Elbow-joint—Conditions for Excision . . . . .	674
Operation and After-treatment . . . . .	674
Results in relation to Mortality . . . . .	674
„ compared with Amputation of Arm . . . . .	674
„ „ with Secondary Excision . . . . .	675
„ Hospitals of England and Scotland (Author's Collection) . . . . .	675
Wrist—Conditions for Excision . . . . .	675
Operation and After-treatment . . . . .	676
Results in relation to Mortality . . . . .	676
„ Hospitals of England and Scotland (Author's Collection) . . . . .	676

## EXCISION OF BONES.

Scapula—Conditions for Excision . . . . .	676
Operation . . . . .	677
With Amputation at Shoulder-joint . . . . .	678
Clavicle Operation . . . . .	678
Radius, or Ulna . . . . .	678
Tibia, or Fibula . . . . .	680

## CHAPTER XXXVIII.—AMPUTATIONS.

General Directions . . . . .	680
Instruments . . . . .	680
Operation—Flap and Circular . . . . .	681
„ Relative Merits . . . . .	683

AMPUTATIONS—*continued.*

Operation—Amputation by Rectangular Flaps . . . . .	684
Dressing of Stump . . . . .	684
Morbid Conditions of Stump . . . . .	685
Healthy Stump . . . . .	687
Double Amputation . . . . .	687
Results of Amputation . . . . .	688
For Injury and Disease . . . . .	689
Primary and Secondary . . . . .	689
Causes of Death . . . . .	690
Particular Amputations of the Fingers . . . . .	690
"    "    of the Thumb . . . . .	692
"    "    of the Little Finger . . . . .	693
"    "    at the Wrist-joint . . . . .	693
Artificial Hands . . . . .	693
"    "    of the Fore-arm . . . . .	693
Artificial Fore-arm . . . . .	694
"    "    of the Arm . . . . .	694
Results . . . . .	695
Artificial Arms . . . . .	696
"    "    at Shoulder-joint . . . . .	696
Results . . . . .	697
"    "    of the Toes . . . . .	697
"    "    of the Great Toe . . . . .	697
"    "    of the Little Toe . . . . .	698
"    "    of the Toes, at Tarso Metatarsal Articulations—Hey's Operation . . . . .	698
"    "    through the Tarsus—Chopart's Operation . . . . .	699
"    "    at Ankle-joint—Syme's Operation . . . . .	700
"    "    "    "    Pirogoff's . . . . .	701
"    "    Sub-astragaloid Amputation . . . . .	701
Hancock's Amputation . . . . .	702
Artificial Foot . . . . .	703
of the Leg . . . . .	703
Artificial Legs . . . . .	704
Results . . . . .	704
"    "    at Knee-joint . . . . .	704
"    "    Supra-condyloid Amputation . . . . .	706
Results, at Knee-joint . . . . .	706
"    "    of the Thigh . . . . .	706
Forms of Artificial Leg . . . . .	709
Results . . . . .	710
"    "    at Hip-joint . . . . .	710
"    "    Below Trochanters . . . . .	711
Results, at Hip-joint . . . . .	712

## SPECIAL PATHOLOGY AND SURGERY.

## DIVISION II.

## INJURIES AND DISEASES OF ORGANS AND REGIONS.

## THE HEAD.

	PAGE
CHAPTER XXXIX.—INJURIES AND DISEASES OF THE SCALP,	
CRANIUM, MEMBRANES OF THE BRAIN, AND BRAIN.	
Injuries of the Scalp . . . . .	713
Wounds . . . . .	713
Contusion . . . . .	714
Cephalhæmatoma . . . . .	714
Injuries of the Cranium . . . . .	714
Contusion of the Bone . . . . .	714
Fractures—of Vault of the Skull . . . . .	715
„ of Base of the Skull . . . . .	719
Injuries of the Membranes of the Brain. . . . .	721
Extravasation of Blood, within the Cranium . . . . .	721
Hernia Cerebri . . . . .	721
Injuries of the Brain . . . . .	722
Concussion . . . . .	722
Contusion . . . . .	724
Compression . . . . .	725
Wounds . . . . .	726
Injuries of the Cranial Nerves . . . . .	726
Traumatic Inflammation . . . . .	727
Abscess . . . . .	729
Trephining . . . . .	729
Tumours of the Head . . . . .	731
Cysts or Wens . . . . .	731
Vascular Tumours—Nævi . . . . .	731
Exostosis . . . . .	731
Fibrous or Fibro-cystic Tumour . . . . .	731
Myeloid Tumour . . . . .	731
Cancer . . . . .	731
Fungous Tumour of Dura Mater . . . . .	731
Congenital Hernial Tumours . . . . .	732
Hydrocephalus and Paracentesis Capitis . . . . .	732

## ORGANS OF SPECIAL SENSE, AND THEIR APPENDAGES.

CHAPTER XL.—OPHTHALMIC SURGERY, OR INJURIES AND  
DISEASES OF THE EYE AND ITS APPENDAGES.

Injuries . . . . .	733
Wounds—of Eyebrows and Eyelids . . . . .	733
„ of Eyeball . . . . .	733



OPHTHALMIC SURGERY—*continued.*

Contusion . . . . .	734
Foreign Bodies . . . . .	735
Diseases of Eyelids . . . . .	736
Hordeolum, or Styne . . . . .	736
Abscess in Meibomian Follicles . . . . .	736
Ophthalmia Tarsi . . . . .	736
Trichiasis . . . . .	737
Entropion . . . . .	737
Ectropion . . . . .	737
Epicanthus . . . . .	738
Ancyloblepharon . . . . .	738
Symblepharon . . . . .	738
Lagophthalmos . . . . .	738
Ptosis . . . . .	738
Spasmodic Twitching of Eyelid . . . . .	739
Hysterical Affections . . . . .	739
Tumours . . . . .	739
Lice . . . . .	739
Of Lachrymal Apparatus . . . . .	739
Tumours of Lachrymal Gland . . . . .	740
Lachrymal Obstructions—Epiphora . . . . .	740
Obstruction of Nasal Duct and Fistula Lachrymalis . . . . .	740
Dacryolithes . . . . .	742
Detached Eyelash . . . . .	742
Of the Conjunctiva . . . . .	742
Conjunctivitis, or Ophthalmia . . . . .	742
Catarrhal Ophthalmia . . . . .	743
Pustular Ophthalmia . . . . .	743
Purulent Ophthalmia . . . . .	743
"          "          in New-born Infants . . . . .	744
Gonorrhœal Ophthalmia . . . . .	745
Scrofulous Ophthalmia . . . . .	745
Granular Conjunctiva . . . . .	746
Growths of Conjunctiva . . . . .	746
Pterygium . . . . .	746
Pinguecula . . . . .	747
Tumours . . . . .	747
Cysticercus telæ Cellulosæ . . . . .	747
Nitrate of Silver Stains . . . . .	747
Of the Cornea . . . . .	747
Corneitis, or Keratitis . . . . .	747
Chronic Interstitial . . . . .	748
Opacities . . . . .	748
Ulcers . . . . .	748
Staphyloma . . . . .	749

OPHTHALMIC SURGERY—*continued.*

Conical Cornea . . . . .	749
Arcus Senilis . . . . .	749
Of the Sclerotic . . . . .	749
Sclerotitis—Rheumatic Ophthalmia . . . . .	749
Of the Iris . . . . .	751
Iritis . . . . .	751
Syphilitic Iritis . . . . .	751
Rheumatic Iritis . . . . .	752
Scrofulous Iritis . . . . .	752
Adhesions of Iris . . . . .	753
Staphyloma Scleroticæ . . . . .	753
Cysts of Iris . . . . .	753
Myosis and Mydriasis . . . . .	753
Artificial Pupil . . . . .	754
Of the Lens and Capsule . . . . .	755
Cataract . . . . .	755
Operations for . . . . .	757
On Infants . . . . .	761
Of the Choroid and Retina . . . . .	761
Choroiditis and Retinitis . . . . .	761
Dimness of Sight . . . . .	761
Defective Sight . . . . .	762
Impaired Vision . . . . .	762
Musæ Volitantes . . . . .	762
Amaurosis . . . . .	762
Ophthalmoscopic Appearances . . . . .	763
Ophthalmoscope . . . . .	765
Healthy appearance of Eye . . . . .	766
Glaucoma . . . . .	767
Iridectomy . . . . .	768
Short Sight—Myopia . . . . .	768
Long Sight—Presbyopia . . . . .	769
Colour-blindness—Acritochromacy . . . . .	769
Day sight—Hemeralopia . . . . .	769
Night sight—Nyctalopia . . . . .	769
Of the Eyeball, or of its Motor Apparatus . . . . .	769
Protrusion of Eyeball . . . . .	769
Dislocation . . . . .	770
Tumours . . . . .	770
Removal of Eyeball . . . . .	770
Strabismus or Squint . . . . .	771

## CHAPTER XLI.—INJURIES AND DISEASES OF THE EAR.

External Ear . . . . .	773
Wounds . . . . .	773

INJURIES AND DISEASES OF THE EAR—*continued*.

Foreign Bodies . . . . .	773
Displacement . . . . .	773
Hypertrophy . . . . .	774
Eczema . . . . .	774
Wax in Meatus . . . . .	775
Thickening of Cuticle . . . . .	775
Polypus . . . . .	775
Otorrhœa . . . . .	776
Fungous Granulations . . . . .	777
Internal Ear . . . . .	777
Otitis . . . . .	777
Artificial Membrana Tympani . . . . .	779
Collapse of . . . . .	779
Eustachian Tubes—Throat Deafness . . . . .	779
Ear-ache—Otalgia . . . . .	780
Deafness . . . . .	780

## CHAPTER XLII.—INJURIES AND DISEASES OF THE NOSE.

Foreign Bodies . . . . .	781
Epistaxis . . . . .	781
Hypertrophy or Lipoma . . . . .	783
Cancer . . . . .	783
Lupus . . . . .	783
Syphilitic Ulcer . . . . .	784
Ozæna or Rhinorrhœa . . . . .	784
Thickening of Schneiderian Membrane . . . . .	785
Polypus . . . . .	786
Gelatinous or Mucous . . . . .	786
Fibrous . . . . .	788
Cancerous . . . . .	788
Tumours of Septum . . . . .	788
Calculi or Rhinoliths . . . . .	791
Plastic Surgery of Nose—Rhino-plastic Operations . . . . .	791

## CHAPTER XLIII.—INJURIES AND DISEASES OF THE MOUTH.

Lips—Wounds . . . . .	795
Hare-lip . . . . .	795
Congenital Transverse Fissures of Cheeks . . . . .	798
Congenital Contraction of Mouth . . . . .	798
Cheiloplastic Operations . . . . .	798
of Lower Lip . . . . .	798
of Upper Lip . . . . .	799
Diseases—Hypertrophy . . . . .	798
Ulceration . . . . .	799

INJURIES AND DISEASES OF THE MOUTH—*continued.*

Tumours . . . . .	799
Encysted . . . . .	800
Erectile . . . . .	800
Epithelial Cancer . . . . .	801
Cheeks—Wounds, and Salivary Fistula . . . . .	801
Tumours . . . . .	801
Corroding Ulcers . . . . .	802
Cancerum Oris . . . . .	802
Tongue—Wounds . . . . .	803
Foreign Bodies . . . . .	803
Tongue-tie . . . . .	803
Prolapsus . . . . .	804
Glossitis . . . . .	804
Tumours—Cancer . . . . .	807
Erectile . . . . .	807
Fatty . . . . .	807
Ranula . . . . .	807
Cysts . . . . .	808
Gums and Teeth—Diseases . . . . .	808
Alveolar Abscess—Gum-boil or Parulis . . . . .	809
Epulis . . . . .	809
Congenital Hypertrophy of Gum . . . . .	810
Polypus . . . . .	810
Vascular Tumours . . . . .	811
Teeth—Injuries and Misplacements . . . . .	811
Eruption of Milk-teeth . . . . .	811
Mal-eruption of Wisdom Teeth . . . . .	811
Irregularities of Permanent Teeth . . . . .	811
Diseases—Caries and Necrosis . . . . .	811
Hæmorrhage after Tooth-extraction . . . . .	813

## CHAPTER XLIV.—DISEASES OF THE JAWS.

Cleft-palate . . . . .	814
Staphyloraphy—Operation of . . . . .	814
Necrosis of Jaws . . . . .	817
Abscess of Antrum . . . . .	818
Dropsy of Antrum . . . . .	819
Tumours . . . . .	820
of Upper Jaw . . . . .	820
of Lower Jaw . . . . .	821
Excision of Upper Jaw . . . . .	822
„ Lower Jaw . . . . .	824
Closure of the Jaws . . . . .	826
Excision of Articulation . . . . .	827



## THE NECK.

CHAPTER XLV.—INJURIES OF LARYNX AND TRACHEA, PHARYNX, AND ŒSOPHAGUS. PAGE

Wounds of the Throat—Cut-throat . . . . .	827
Foreign Bodies in the Air-passages . . . . .	830
Scalds of the Glottis, Mouth, and Pharynx . . . . .	832
Asphyxia or Apnoea . . . . .	832
Artificial Respiration . . . . .	835
Foreign Bodies . . . . .	836
Pharyngotomy and Œsophagotomy . . . . .	838

## CHAPTER XLVI.—DISEASES OF PHARYNX AND ŒSOPHAGUS, LARYNX, AND TRACHEA.

Tonsillitis . . . . .	838
Chronic Enlargement of Tonsils . . . . .	839
Elongation or Relaxation of Uvula . . . . .	840
Tumours of Velum Palati . . . . .	841
Pharyngitis . . . . .	841
Tumours of the Pharynx . . . . .	842
Stricture of Œsophagus . . . . .	842
Gastrotomy . . . . .	843
Paralysis of Œsophagus . . . . .	844
Dilatation and Sacculation . . . . .	844
Use of Stomach-pump . . . . .	844
Laryngitis . . . . .	845
Laryngoscope . . . . .	845
Laryngoscopy . . . . .	846
Treatment of Laryngeal Affections . . . . .	847
Laryngotomy and Tracheotomy . . . . .	848

## CHAPTER XLVII.—DISEASES OF THE THYROID GLAND. THE PAROTID GLAND. TUMOURS OF THE NECK.

## Thyroid Gland.

Bronchocele or Goitre . . . . .	850
Inflammation of Thyroid Gland . . . . .	853
Fibrous, Cartilaginous, and Osseous Formations.	
Tubercle. Cancer . . . . .	853
Hernia Bronchialis . . . . .	853

## Parotid Gland.

Parotitis or Mumps . . . . .	853
Glandular Parotid Tumour . . . . .	853
Tumours in Parotid Region . . . . .	854

## Tumours of the Neck.

Enlargement of Cervical Glands . . . . .	855
Induration of the Sterno-mastoid Muscle . . . . .	855

DISEASES OF THE THYROID, &c.—*continued*.

Enlarged Bursæ . . . . .	855
Cysts . . . . .	855
Fatty, and other Tumours . . . . .	856

## CHAPTER XLVIII.—INJURIES AND DISEASES OF THE SPINE.

Anatomy and Physiology of Spine or Vertebral Column . . . . .	856
Wounds . . . . .	857
Sprains . . . . .	857
Intra-spinal Hæmorrhage . . . . .	858
Inflammation of Joints of Spine . . . . .	858
Fractures . . . . .	859
Dislocation . . . . .	859
Concussion of Spinal Cord . . . . .	861
Spinal Meningitis . . . . .	862
Spinal Myelitis . . . . .	862
Compression of Spinal Cord . . . . .	867
Disease of the Spine . . . . .	867
Psoas Abscess . . . . .	869
Varieties of Spinal Abscess . . . . .	870
Disease of Atlas and Axis . . . . .	872
Lateral Curvature . . . . .	873
Posterior Curvatures—Cyphosis and Lordosis . . . . .	880
Spina Bifida . . . . .	881

## THE THORAX.

## CHAPTER XLIX.—INJURIES OF THORACIC PARIETES, AND ORGANS.

Wounds of Parietes of Chest . . . . .	882
Wounds involving Thoracic Organs . . . . .	882
Hernia of Lung or Pneumatocele . . . . .	886
Pneumothorax . . . . .	886
Emphysema . . . . .	886
Hæmothorax . . . . .	887
Hydrothorax . . . . .	887
Empyema . . . . .	888
Paracentesis Thoracis . . . . .	888
Hydrops Pericardii . . . . .	889
Deformity of Chest . . . . .	889

## CHAPTER L.—DISEASES OF THE BREAST.

Physiological and Anatomical Relations of Mammary Gland . . . . .	890
General Pathology and Diagnosis . . . . .	891
Method of Examining the Breast . . . . .	891
Inflammation, or Mastitis . . . . .	892
Scrofulous Enlargement . . . . .	893

DISEASES OF THE BREAST—*continued.*

	PAGE
Inflammation of Nipple . . . . .	893
Chronic Induration . . . . .	894
Irritable Mamma . . . . .	894
Hypertrophy . . . . .	894
Atrophy . . . . .	895
Tumours . . . . .	895
Adenocoele or Adenoid Tumour . . . . .	895
Fibrous Tumour—Neuroma . . . . .	897
Fatty Tumour . . . . .	897
Cartilaginous and Osteoid Tumours . . . . .	897
Cysts and Cystic Tumours . . . . .	898
Cancer—Scirrhus . . . . .	899
Encephaloid . . . . .	900
Colloid . . . . .	901
Recurrent Cancer . . . . .	904
Amputation of Breast . . . . .	904
Functional Disorders of Breast . . . . .	906
Abnormal Secretion of Milk . . . . .	906
Excessive Lacteal Secretion, or Galactorrhœa . . . . .	906
Deficient Lacteal Secretion, or Agalactia . . . . .	906
Congestion with Milk . . . . .	906
Diseases of Male Breast . . . . .	906
Anomalies of Development . . . . .	907
Absence of Breast . . . . .	907
Supernumerary Breasts or Nipples . . . . .	907

## THE ABDOMEN.

## CHAPTER LI.—INJURIES OF ABDOMINAL PARIETES, AND VISCERA.

Contusion . . . . .	907
Wounds of Parietes . . . . .	908
Injuries implicating Viscera . . . . .	908
Rupture or Penetrating Wound . . . . .	908
Protrusion . . . . .	909
Traumatic Peritonitis . . . . .	912

## CHAPTER LII.—HERNIA.

General Pathology of Abdominal Hernia . . . . .	913
Situations of Herniæ . . . . .	917
Names of Herniæ . . . . .	917
Causes . . . . .	918
Reducible Hernia . . . . .	919
Treatment—Taxis . . . . .	920
Radical Cure—Operations for . . . . .	921
Irreducible Hernia . . . . .	921

HERNIA—*continued*.

Treatment . . . . .	922
Incarcerated . . . . .	922
Strangulated . . . . .	923
Diagnosis . . . . .	924
Operation—Herniotomy . . . . .	928
Results . . . . .	935
Artificial Anus . . . . .	935
Double Hernia . . . . .	937

## CHAPTER LIII.—SPECIAL HERNIE.

Inguinal Hernia . . . . .	938
Oblique Inguinal Hernia . . . . .	938
Anatomy . . . . .	939
Seat of Stricture . . . . .	940
Direct Inguinal Hernia . . . . .	940
Anatomy . . . . .	940
Seat of Stricture . . . . .	941
Signs of Inguinal Hernia . . . . .	941
Congenital Hernia . . . . .	942
Infantile or Encysted Hernia . . . . .	944
Diagnosis of Inguinal Hernia . . . . .	945
Treatment . . . . .	948
Reducible, and Trusses . . . . .	948
Radical Cure. Operations . . . . .	950
Irreducible . . . . .	957
Strangulated. Operation . . . . .	957
Congenital Hernia . . . . .	958
Infantile or Encysted . . . . .	959
Femoral or Crural Hernia . . . . .	959
Anatomy . . . . .	960
Seat of Stricture . . . . .	962
Varieties . . . . .	962
Signs and Diagnosis. . . . .	963
Treatment . . . . .	965
Reducible, and Trusses . . . . .	965
Radical Cure. Operation . . . . .	965
Irreducible . . . . .	967
Strangulated. Operation . . . . .	967
Umbilical Hernia . . . . .	970
Anatomy . . . . .	970
Seat of Stricture . . . . .	971
Signs . . . . .	971
Treatment . . . . .	972
Reducible, and Trusses . . . . .	972

	PAGE
SPECIAL HERNIA— <i>continued.</i>	
Irreducible . . . . .	973
Strangulated. Operation . . . . .	973
Ventral Hernia . . . . .	973
Lumbar Hernia . . . . .	974
Obturator or Thyroid Hernia . . . . .	974
Perinæal Hernia . . . . .	975
Vaginal Hernia . . . . .	975
Pudendal Hernia . . . . .	975
Ischiatic Hernia . . . . .	976
Diaphragmatic Hernia . . . . .	976
CHAPTER LIV.—INTESTINAL OBSTRUCTION.	
Intestinal Conditions or Causes . . . . .	977
Symptoms and Diagnosis . . . . .	978
Treatment . . . . .	979
Gastrotomy . . . . .	981
Colotomy . . . . .	982
CHAPTER LV.—PARACENTESIS ABDOMINIS.	
Operation of Tapping Abdomen . . . . .	983
CHAPTER LVI.—DISEASES, INJURIES, AND MALFORMATIONS OF RECTUM AND ANUS.	
Diseases . . . . .	985
Inflammation and Rectal Abscess . . . . .	985
Fistula in Ano . . . . .	986
Ulcer of Rectum, and Fissure of Anus . . . . .	991
Hæmorrhoids—External and Internal . . . . .	993
Prolapsus of Rectum . . . . .	1002
Polypus of Rectum . . . . .	1005
Stricture of Rectum . . . . .	1007
Rectal Fistula . . . . .	1010
Recto-Vesical . . . . .	1010
Recto-Vaginal . . . . .	1011
Anal Tumours . . . . .	1012
Anal Contraction . . . . .	1012
Injuries . . . . .	1012
Wounds . . . . .	1012
Foreign Bodies . . . . .	1013
Congenital Malformations . . . . .	1014
Imperforate Anus . . . . .	1014
Imperforate Rectum . . . . .	1014
Rectal Communications with Bladder, Vagina, Pe- rinæum . . . . .	1016



DISEASES, INJURIES, &c.—*continued.*

Functional Disorders . . . . .	1017
Atony of Rectum . . . . .	1017
Irritable Rectum, or Sphincter . . . . .	1017
Neuralgia of Rectum, or Anus . . . . .	1018
Pruritus Ani . . . . .	1018

## THE GENITO-URINARY ORGANS.

CHAPTER LVII.—INJURIES AND DISEASES OF THE BLADDER—  
AND URINARY CALCULUS.

Injuries . . . . .	1019
Laceration and Rupture of Bladder . . . . .	1020
Rupture of Ureter . . . . .	1020
Foreign Bodies . . . . .	1020
Urinary Calculus . . . . .	1021
Origin and Production . . . . .	1021
Physical Properties . . . . .	1022
Structure . . . . .	1022
Chemical Composition . . . . .	1023
Relative frequency of different Calculi . . . . .	1023
Uric or Lithic Acid Calculus . . . . .	1024
Tests . . . . .	1024
Urate of Ammonia Calculus . . . . .	1024
Tests . . . . .	1024
Urates of Soda or Lime . . . . .	1024
Uric or Xanthic Oxide . . . . .	1024
Tests . . . . .	1024
Cystic Oxide or Cystine Calculus . . . . .	1024
Tests . . . . .	1025
Fibrinous Calculus . . . . .	1025
Tests . . . . .	1025
Uro-Stealith Calculus . . . . .	1025
Tests . . . . .	1025
Blood Calculus . . . . .	1025
Tests . . . . .	1025
Carbonate of Lime Calculus . . . . .	1025
Tests . . . . .	1025
Oxalate of Lime Calculus . . . . .	1026
Varieties . . . . .	1026
Tests . . . . .	1026
Phosphate of Ammonia and Magnesia-Triple Phos- phate Calculus . . . . .	1026
Tests . . . . .	1026
Phosphate of Lime . . . . .	1026
Tests . . . . .	1026

INJURIES AND DISEASES OF THE BLADDER—*continued.*

Phosphate of Lime, and Phosphate of Magnesia and Ammonia—Mixed Phosphates—Fusible Calculus . . . . .	1027
Tests . . . . .	1027
Silicious Calculus . . . . .	1027
Tests . . . . .	1027
Chemical Examination of Calculi . . . . .	1027
Appliances and Tests . . . . .	1027
Order of Examination . . . . .	1027
Table for Examining Urinary Calculi . . . . .	1028
Causes of Urinary Calculi . . . . .	1029
Climate and Locality . . . . .	1029
Hereditary tendency . . . . .	1029
Sex . . . . .	1029
Period of Life or Age . . . . .	1029
Habits of Life . . . . .	1029
Morbid conditions of Urinary Organs . . . . .	1030
Renal Calculus . . . . .	1030
Treatment . . . . .	1030
Stone in the Bladder . . . . .	1031
Symptoms, and Sounding the Bladder . . . . .	1031
Encysted Calculus . . . . .	1034
Diagnosis . . . . .	1034
Consequences and Terminations . . . . .	1035
Treatment . . . . .	1036
Operations . . . . .	1036
Lithotomy . . . . .	1036
Lateral Operation . . . . .	1037
Cutting on a Straight Staff . . . . .	1044
In Children . . . . .	1046
Anatomical Peculiarities . . . . .	1046
Difficulties and Accidents . . . . .	1048
In Adults . . . . .	1048
In Children . . . . .	1048
After-treatment . . . . .	1052
Consequences . . . . .	1052
Causes of Death, and Results . . . . .	1053
Recurrence of Stone . . . . .	1054
Median Lithotomy . . . . .	1055
The Old Marian Operation . . . . .	1055
Allarton's Operation . . . . .	1055
Compared with Lateral Operation . . . . .	1056
Results . . . . .	1056

	PAGE
INJURIES AND DISEASES OF THE BLADDER— <i>continued.</i>	
Rectangular Staff Operation . . . . .	1056
Comparative estimate of . . . . .	1056
Bilateral Lithotomy . . . . .	1056
Results . . . . .	1057
Medio-bilateral Operation . . . . .	1057
Quadrilateral Section of Prostate . . . . .	1057
Recto-vesical Operation . . . . .	1057
Comparative estimate of . . . . .	1057
Results . . . . .	1057
Supra-Pubic—Hypo-gastric, or High Operation . . . . .	1057
Compared with Lateral Operation . . . . .	1057
Results . . . . .	1058
Lithotritry . . . . .	1058
After-treatment . . . . .	1063
Difficulties and Dangers . . . . .	1064
Results, and as compared with Lithotomy . . . . .	1065
Selection of Lithotomy, or Lithotritry . . . . .	1065
Conditions determining Selection . . . . .	1065
Recurrence of Stone . . . . .	1068
Treatment . . . . .	1068
Calculus in the Female . . . . .	1068
Symptoms . . . . .	1069
Treatment . . . . .	1069
Operations . . . . .	1069
Dilatation of Urethra . . . . .	1069
Dilatation, with partial slitting up . . . . .	1069
Double incision . . . . .	1070
Lithotritry . . . . .	1070
Lithotomy . . . . .	1070
Urethral . . . . .	1070
Direct . . . . .	1070
Vagino-vesical . . . . .	1070
Supra-pubic . . . . .	1071
Solution of Stone in Bladder . . . . .	1071
Electrolysis . . . . .	1071
CHAPTER LVIII.—DISEASES OF THE BLADDER.	
Cystitis—acute . . . . .	1072
Chronic . . . . .	1073
Tumours . . . . .	1074
Fibrous—Warty—Polypoid . . . . .	1074
Villous, or Vascular . . . . .	1075
Cancer . . . . .	1075
Tubercle . . . . .	1076

DISEASES OF THE BLADDER—*continued.*

Hæmaturia . . . . .	1076
Causes . . . . .	1076
Treatment . . . . .	1077
Malformations . . . . .	1077
Absence, with communications of Ureters—Urethral,	
Rectal, Vaginal . . . . .	1077
Two or more Bladders . . . . .	1077
Extroversion of Bladder . . . . .	1077
Operations . . . . .	1078
Wood's Operation . . . . .	1078
After-treatment . . . . .	1079
Results . . . . .	1079
Functional Morbid Conditions . . . . .	1079
Irritability of the Bladder . . . . .	1080
Spasm . . . . .	1082
Neuralgia . . . . .	1082
Paralysis . . . . .	1082
Atony, from over-distension . . . . .	1083
Frequent Micturition . . . . .	1083
Incontinence of Urine . . . . .	1083
Engorgement and Overflow . . . . .	1084
Retention of Urine . . . . .	1084

## CHAPTER LIX.—DISEASES OF THE PROSTATE.

Inflammation—Prostatitis . . . . .	1085
Abscess . . . . .	1085
Chronic Enlargement . . . . .	1086
Atrophy . . . . .	1093
Cancer . . . . .	1093
Cysts . . . . .	1094
Tubercle . . . . .	1094
Prostatic Calculus . . . . .	1094

## CHAPTER LX.—DISEASES OF THE URETHRA.

Inflammation—Urethritis . . . . .	1095
Gonorrhœa—Blennorrhagia . . . . .	1096
Gleet . . . . .	1098
Complications . . . . .	1099
Consequences . . . . .	1100
Gonorrhœa in the Female . . . . .	1102
Stricture . . . . .	1103
Organic or Permanent Stricture . . . . .	1103
Situation . . . . .	1103
Symptoms . . . . .	1104

DISEASES OF THE URETHRA—*continued*.

Varieties . . . . .	1105
Causes . . . . .	1107
Consequences and Terminations . . . . .	1108
Treatment . . . . .	1109
Gradual Dilatation . . . . .	1109
Difficulties and Accidents . . . . .	1111
Immediate and Forcible Dilatation or Rupture . . . . .	1112
Results . . . . .	1113
Caustics . . . . .	1114
Division of Stricture . . . . .	1114
Internal Urethrotomy . . . . .	1114
Results . . . . .	1115
External Urethrotomy . . . . .	1115
Perinæal Section . . . . .	1115
Results . . . . .	1116
Spasmodic Stricture . . . . .	1117
Inflammatory Stricture . . . . .	1118
Tumours in Urethra . . . . .	1118
Urethral Calculus . . . . .	1119
Retention of Urine . . . . .	1120
Causes . . . . .	1120
Consequences . . . . .	1120
Treatment . . . . .	1120
Catheterism . . . . .	1120
Incision of Urethra . . . . .	1121
Puncture of Bladder through Rectum . . . . .	1121
Above Pubes . . . . .	1122
Through Symphysis Pubis . . . . .	1122
Extravasation of Urine . . . . .	1123
Rupture of Bladder . . . . .	1124
Urinary Abscess . . . . .	1124
Urinary Fistula . . . . .	1125
Varieties . . . . .	1125
Urethro-plastic Operations . . . . .	1126
Urinary-Vaginal, and Uterine Fistula . . . . .	1127
Operations . . . . .	1127

## CHAPTER LXI.—INJURIES AND DISEASES OF PENIS.

Injuries . . . . .	1129
Wounds, and Laceration . . . . .	1129
Hæmorrhage . . . . .	1129
Wound of Urethra . . . . .	1129
Diseases . . . . .	1130
Balanitis and Posthitis . . . . .	1130



INJURIES AND DISEASES OF PENIS—*continued*.

Phymosis . . . . .	1131
Congenital . . . . .	1131
Circumcision . . . . .	1132
Paraphymosis . . . . .	1132
Gangrene of Prepuce . . . . .	1133
Hypertrophy of Prepuce . . . . .	1133
Warts . . . . .	1133
Cancer of Penis . . . . .	1133
Scirrhus, and Epithelial . . . . .	1134
Amputation of Penis . . . . .	1134
Tumours—non-malignant . . . . .	1135
Malformations . . . . .	1135
Deficiency of Urethra . . . . .	1135
Hypospadias . . . . .	1135
Epispadias . . . . .	1135
Absence of Urethra . . . . .	1135

CHAPTER LXII.—DISEASES OF THE SCROTUM, TESTIS, AND  
CORD.

Diseases of Scrotum . . . . .	1136
Inflammatory Œdema . . . . .	1136
Anasarca . . . . .	1136
Œdema in New-born Infants . . . . .	1136
Elephantiasis or Hypertrophy . . . . .	1136
Excision, and Results . . . . .	1137
Tumours . . . . .	1137
Fibrous Tumour . . . . .	1137
Epithelial or Soot-Cancer . . . . .	1137
Diseases of Testis and Cord . . . . .	1138
Hydrocele . . . . .	1138
Hydrocele of Tunica Vaginalis . . . . .	1139
Varieties of Hydrocele . . . . .	1140
Congenital Hydrocele . . . . .	1143
Encysted Hydrocele . . . . .	1143
Hydrocele of Spermatic Cord . . . . .	1144
Hæmatocele . . . . .	1144
Hæmatocele of Tunica Vaginalis . . . . .	1145
Encysted Hæmatocele of the Testis or Cord . . . . .	1146
Varicocele . . . . .	1146
Orchitis, and Epididymitis . . . . .	1149
Chronic Enlargement . . . . .	1151
Syphilitic Sarcocoele . . . . .	1151
Scrofulous Sarcocoele . . . . .	1152

DISEASES OF THE SCROTUM, TESTIS, AND CORD—*continued*.

Abscess in Testicle . . . . .	1153
Hernia Testis . . . . .	1153
Tumours . . . . .	1153
Cystic Tumour . . . . .	1153
Varieties . . . . .	1154
Fibrous Tumour . . . . .	1155
Cartilaginous Tumour—Enchondroma . . . . .	1155
Cancer . . . . .	1155
Encephaloid . . . . .	1155
Scirrhus . . . . .	1155
Castration, and Results . . . . .	1157
Atrophy of Testicle . . . . .	1158
Functional Disorders . . . . .	1158
Spermatorrhœa . . . . .	1158
Impotence . . . . .	1161
Congenital . . . . .	1161
Neuralgia of Testicle . . . . .	1162
Malposition of Testicle. Congenital . . . . .	1162
Diseases of Retained Testicle . . . . .	1163
Mis-descent of Testicle . . . . .	1163
Inversion of Undescended Testicle . . . . .	1163
Diseases of Vesiculæ Seminales . . . . .	1163

## CHAPTER LXIII.—DISEASES OF FEMALE GENITAL ORGANS.

External Organs . . . . .	1164
Wounds of Vulva, or of Vagina . . . . .	1164
Laceration of Perinæum . . . . .	1164
Foreign Bodies in Vagina . . . . .	1166
Diseases—Hypertrophy of Labia, or of Clitoris . . . . .	1166
Condylomata or Verruæ . . . . .	1166
Abscess of Labium . . . . .	1167
Cystic Tumours . . . . .	1167
Epithelial Cancer . . . . .	1167
Rodent Ulcer . . . . .	1167
Erectile Tumour . . . . .	1167
Closure of Labiæ, or of Vagina . . . . .	1168
Imperforate Hymen . . . . .	1168
Rectal and Vaginal Fistulæ . . . . .	1169
Prolapsus Vaginæ . . . . .	1169
Tumours . . . . .	1169
Uterus . . . . .	1169
Displacements . . . . .	1169
Prolapsus and Procidentia . . . . .	1169

DISEASES OF FEMALE GENITAL ORGANS—*continued.*

Tumours . . . . .	1170
Fibrous . . . . .	1170
Polypi . . . . .	1172
Cancer . . . . .	1173
Absence of Uterus, and Ovaries . . . . .	1174
Ovaries . . . . .	1174
Tumours . . . . .	1174
Fibrous. Cancerous . . . . .	1174
Cystic, and Ovarian Dropsy . . . . .	1174
Treatment . . . . .	1176
Tapping . . . . .	1176
Obliteration by Injection . . . . .	1176
Ovariectomy . . . . .	1177
Conditions for Operation . . . . .	1177
Operation . . . . .	1179
After-treatment . . . . .	1181
Results . . . . .	1181

## ERRATA.

- Page xix. of Contents, line 10, *for* "Surgical," *read* "Lingual Artery."  
 „ 176, line 30, *for* "suspicious," *read* "suspicious."  
 „ 207, line 17, *for* "sequichloride," *read* "sesquichloride."  
 „ 531, line 7, *for* "ends," *read* "end."  
 „ 1056, line 8, *for* "muscles," *read* "vessels."



THE  
SCIENCE AND PRACTICE  
OF  
SURGERY.

---

SURGERY is that primary division of Medicine, which has for its object the cure or the relief of morbid conditions of the body, in a corresponding division of Pathology. But the line of separation is arbitrary, conventional, and indefinite.

*Firstly*, as to the nature of the morbid conditions, or Surgical Pathology. All injuries, malformations, and deformities, congenital and acquired, and all diseases affecting external parts, are usually allotted to Surgery.

*Secondly*, in respect to the kind of Treatment, or the means of cure or relief. Surgery comprises all operations effected by instruments, manipulative procedures, and the employment of mechanical appliances; but it also has recourse to the administration of medicinal agents, and of hygienic measures.

Surgical Pathology is both General and Special. *General* Surgical Pathology comprises the different forms of Injury and Disease which are common to all parts of the body; and these morbid conditions, illustrating the laws of Pathology, are the primary source of guidance in all surgical practice.

As general forms of Injury—Wounds, Fractures, Dislocations, and Aneurisms, are naturally associated; and in virtue of the various laws whereby these lesions undergo Reparation, through processes which are more or less clearly referable to modifications of healthy Nutrition. But this department will be more conveniently considered in connexion with the particular Textures injured. Inflammation, Morbid Growths or Tumours, and Degenerations, may also be referred to modifications of Nutrition; namely, to Accelerated, to Reproductive, and to Declining Nutrition. Certain Blood-diseases, Contagious diseases, and general diseases of the Nervous System, further illustrate the laws of Pathology and Physiology.

*Special* Surgical Pathology may be subdivided into injuries and diseases of the Textures and Textural Systems—*e.g.*, the Skin and the Vascular System, and those which, with malformations, pertain to Organs and Regions—*e.g.*, the Organs of Special Sense, and of Reproduction. The latter subdivision, as a mode of classification, makes no pretension to any scientific distinctions; it is simply an anatomical or a topographical arrangement of morbid conditions.



The pathology of injuries and diseases, taken individually, embraces : (1) the particular structural condition presented, its signs and symptoms, and its diagnosis or detection and discrimination from other conditions; (2) its cause or causes, or etiology, and the effects of the morbid condition itself as a cause; (3) its course, terminations, and consequences, and the prognosis or foreknowledge of these events.

The treatment in any case may be operative, or medicinal, or both.

If in addition to the laws of Pathology, the guiding elements be selected in describing each form of Injury and Disease, and general Principles be established which shall govern its diagnosis, etiology, prognosis, and treatment, the whole of this guiding knowledge will constitute the SCIENCE of Surgery. The Principles here alluded to, form the design of my "Principles of Surgery"; and references, for the convenience of those who have that work, are made thereto, in the course of this volume. Such references are denoted by P., with the page, in brackets; as thus, [P. p. ]. But the two works are quite independently complete, each of the other.

Regarded as an ART, Surgery may, like most other Arts, be practised in either of two ways: Empirically, by experience alone, or as a Scientific Art, by the guidance of the Science pertaining to it. In other words, there may be an empirical, or a scientific practice of diagnosis, etiological investigation, prognosis, and treatment; according as these branches of inquiry have, or have not, a dependence on guiding pathological knowledge and principles. The Practice of Surgery, as a Scientific Art, might, in a restricted sense, have regard only to treatment, and this has been exclusively or principally its signification—Rules of Treatment having been designated the Principles of Surgery; but in its more extended meaning, the Art would also have reference to the application of Principles in the other, and preparatory, branches of inquiry.

The relative importance of these three aspects of inquiry respecting morbid conditions, as to their nature, causes, courses and terminations, and of the whole of this pathological knowledge in relation to treatment, may be briefly estimated as follows.

1. *Diagnosis* is primarily necessary, in order to discover the particular structural condition, situation, and extent of the injury or disease, when capable of being so defined, and its distinction from other conditions.

To make this discovery, the concomitant effects of the morbid condition are taken as *Signs* or *Symptoms* of its existence. The relative value of such evidence will depend upon, and vary with, its more or less constant and exclusive conjunction with the morbid condition. Accordingly, a Symptom, or as the etymological meaning of this term would express, a coincidence or co-occurrence, is less characteristic and distinctive than a Sign, the latter being that by which anything is known or recognised. Any sign peculiar to a morbid condition is named *pathognomonic*.

The earliest and most exact source of diagnosis is Pathological Anatomy, as directly manifesting during life the essential nature of the morbid condition, by the physical, the structural, or the chemical changes which the part affected undergoes.

Diagnosis may be corroborated by Pathology—i.e., the functional disturbances accompanying the particular disease or injury; also by connecting the morbid condition with its external cause, and by the characteristic effects of the therapeutic measures employed.

For example, the fact of an individual having been exposed to

malaria, is evidence presumptive that he may have ague; whilst the fact of his disease disappearing by the administration of quinine alone, is, among *other* evidence, corroborative of that disease being ague.

But the diagnostic value of all such *circumstantial* evidence is regulated by its more or less *constant* and *exclusive* association with the disease or injury which is sought to be identified.

Viewed in this light, the evidence of Pathology—functional disturbances—of external causes, and the effects of therapeutic measures, possess different degrees of diagnostic value; but the assurances derived from all these resources are, at the best, equivocal, and therefore misleading. Here it is that Pathological Anatomy, applied during life—Clinical Pathological Anatomy—comes to our aid.

By an appeal to the “physical” properties of organs and textures, as discovered *during life*, we can *partly* corroborate or rectify our interpretation of mere functional symptoms.

By the “structural” character of morbid products and secretions discharged from the natural passages—as the mouth, œsophagus, stomach, and intestines; the lungs, urinary bladder, kidneys, uterus, and vagina; those also which are externally yielded by or through the skin, or procured by puncture, as from tumours; possibly, in some cases, by “chemical” analysis of some such materials; we gain *direct* insight into, and evidence respecting, the structural conditions of *most* internal organs and of morbid products issuing from them.

Such application of Pathological Anatomy, therefore, directly indicates the *exact* structural condition, the situation, and even the extent, of the disease; and by virtue of this qualification, as a method of diagnosis, is more trustworthy than the evidence of Pathology, or any other collateral testimony.

The superiority of physical diagnosis, by virtue of the *earliness* with which the physical characters of a disease become obvious during life, is impaired by its inferiority in respect of *exactitude*, as compared with structural diagnosis.

Duly weighing all these considerations, we arrive at this conclusion—that it is only by careful and repeated clinical observation of the “physical,” the “structural,” and, if possible, the “chemical” conditions—which taken *collectively*, are the *constant* signs of disease; by a similar observation of any collateral *circumstances* of evidence—*i.e.*, alterations of function; precurrence of external causes, and the effects of therapeutic measures; and by connecting *all* this evidence during life, with certain pathologico-anatomical alterations, as demonstrated by the scalpel, the microscope, and possibly, by chemical analysis after death—that we can rationally hope to establish the *earliest* and *most exact* diagnosis.

This connexion, oft-recurring, at length begets self-confidence; so that with the accumulation of such experience our diagnosis, although determined during life, and therefore by evidence not infallible, yet having been repeatedly verified by *post-mortem* examination, now supplies a proportionately sure *basis* for Therapeutics.

2. *Etiology* comprises the knowledge of causes, and their operation, in the production of injury or disease. Such causes may be *external* to the body, as external violence in the production of injury, or exposure to cold in inducing disease; or, they may be *internal*, by the excess, deficiency, or perversion, of structure and function. Both classes of causes may be either *predisposing*, or *immediate* and exciting, in their opera-

tion. Sometimes, the former occurs after the latter mode of causation, as when an individual undergoes fatigue or privation, after exposure to an infectious poison. Then, that weakening of the system cannot be said to predispose, but it is aptly named the *determining* cause.

An innate power of resisting the supervention of morbid conditions, explains why the same cause does not invariably produce its reputed effect in different individuals, or in the same individual, at different periods of life; this uncertainty being due to different degrees of resisting power. But the influence of habitual toleration will also much affect the operation of causes, whether external or internal.

Either kind of cause may be self-sufficient, but both kinds frequently co-operate, or operate in succession; the internal cause more commonly predisposing, the external, when sufficiently aided thereby, immediately inducing disease, or, occasionally, injury. Thus, a fall which does not produce a hernial protrusion in one case, immediately does so in another, owing to weakness of the abdominal wall at the seat of rupture, as the structural predisposing condition to this lesion; and a posture which does not cause an apoplectic seizure in one case, immediately does so in another, owing to the blood-vessels of the brain having become brittle from calcareous degeneration.

Causes are also distinguished as *local* and *constitutional*. The former term requires no definition; the latter signifies such conditions of disease as have a systemic character, and a correspondingly widespread influence, in the production of local manifestations. Such are principally diseases of the blood, of the nervous system, or of nutrition. Local causes may give rise to constitutional diseases; and conversely, any constitutional cause must give rise to, and be manifested by, some local affection or affections. Thus we speak often of the constitutional origin of local disease, a general and most important doctrine of etiology, originally taught by Abernethy.

The detection of internal causes, whether local or constitutional, may be regarded as an extension of diagnosis, and consequently pertains chiefly to Clinical Pathological Anatomy; but the operation of these causes, through functional disturbances, comprises the study of Pathology.

3. *Prognosis*, or foreknowledge of the course and terminations of injuries and diseases, implies their continued functional disturbances, and as such an enlarged study of Pathology.

4. *Treatment* derives its Indications from each of the three foregoing heads of inquiry respecting morbid conditions. Diagnosis fixes the essential nature of the morbid condition, and thus not unfrequently indicates the requisite remedial measures, particularly as to surgical operations, manipulative procedures, and mechanical appliances; etiology supplies the knowledge of causes, which, if they be still in operation, must be removed; and prognosis determines the remaining indications of treatment.

A considerable portion of surgical treatment yet remains empirical; but it is now generally felt and acknowledged to be proportionately aimless, and as often therefore unsuccessful. Such treatment of injury or disease is like trying to hit a mark blindfolded. It can, indeed, only be regarded as a temporary resource, accepted by the Practitioner under the pressure of his natural anxiety to relieve human suffering in any possible way, but as often little better than nothing until enlightened by Pathology.

As thus directed, however, Treatment acquires three primary Indica-



tions of the highest importance. In proportion as the natural course of any morbid condition is towards an unfavourable issue, the Surgeon thence discovers the *earliest occasion* for interference, and the unfavourable conditions to be removed; while, in proportion as the Natural Course is towards recovery, it indicates the *least amount* as well as the *kind* of surgical assistance requisite, from time to time, to conduct the case to this happy issue. These three Indications of Treatment may be recognised more especially in respect to the general forms of Injury and Disease.

Treatment in accordance with the natural course of morbid conditions towards *recovery*, is evidently responsive to the requirements of a self-restorative or reparative power, which is inborn and inherent in the living body. Hence, I have long since designated such remedial treatment, "Conservative," whether in Surgery or Medicine, as denoting its preservative power, the timeliness and moderation of its remedial assistance. ("Medical Times and Gazette," 1864-65.) The term "Conservative Surgery," as originally understood, when introduced by Sir W. Fergusson in 1852 ("Medical Times and Gazette"), was restricted to operations for the preservation of some part of the body, which would otherwise have been inconsiderately and unnecessarily sacrificed. The performance of some operation of removal having become necessary, in consequence of an incurably diseased or injured state of a part; a lesser and limited operation, the extirpation of that part alone, may then be sufficient, instead of an operation involving also any portion of the sound organism. Of two, or more, practicable operations of removal, this consideration of anatomical preservation, may thus guide the Surgeon's choice. For example, excision of an incurable diseased joint, may be performed, instead of amputation of the limb. Thus, observes Sir W. Fergusson, a compromise may be made, whereby the original constitution and frame, as from the Maker's hand, may be kept, as nearly as possible, in its normal condition.

*Pathology in Surgical Operations.*—In the *design* and *performance* of Surgical Operations, the Guidance of Pathology, supplements and completes that of purely healthy Anatomy; this conjunction giving rise to what I have designated "Pathological Operative Surgery." (Ibid., 1865.)

The contrast between the Continental and the English Schools of Surgery, mainly turns on this more intimate incorporation of Pathology with Operative Surgery. Thus, in France, we find that it was advocated: by Sabatier (1832), Lisfranc (1845), Vidal (de Cassis) (1846), Sédillot (1853), Malgaigne (1861), Chassaignac (1861), Velpeau, and Nélaton. In Germany, the same position is urged by Chelius, Lühart, Dieffenbach, and Langenbeck. In Italy, by Scarpa (1809). America also has responded to this spirit of progress, as testified by Mott, Physick, and Gross. In this country, its influence has been more slowly felt. For, although in Scotland, so long since as 1801, John Bell overthrew the Anatomy of Surgery, as *then* taught in the schools, his denunciation was as "the voice of one crying in the wilderness;" and in England the purely Anatomical Operative Surgery of his brother, Sir Charles Bell, long prevailed. Nearly fifty years afterwards (1846) Liston noticed the influence of Pathological Anatomy on the "Abridgment" of Operative Surgery; by Sir William Fergusson, its occasional applicability in surgical operations was acknowledged in the third edition of his *Practical Surgery* (1852); and Skey recognised it in like manner in the second edition of his *Operative Surgery* (1858). In March, 1864, I brought prominently forward

in my "Principles of Surgery," the Guidance of Pathology in Surgical Operations, as a general Principle; positively true, in the great majority of operations, where the seats of operation and of disease or injury are identical; negatively true, in other operations, where the object is to operate clear of the disease and amid healthy tissues. I followed up this position at the dates already referred to; and more recently, Mr. Hancock endorsed the principle, as regards Surgical Operations on the foot, in his Lectures at the Royal College of Surgeons, 1866. Having exposed at some length "the very grave error," with reference to diseases of the foot, of "reducing conservative to mere anatomical Surgery;" he observes—"Experience has proved that we may do much more good by regulating our operative proceedings by the amount and character of the mischief; and hence I would venture, as suggested by Mr. Gant, to designate the Surgery of the foot, 'Pathological Surgery of the foot,' as being more comprehensive, as imposing this law upon us more strongly than does the term 'Conservative Surgery,' and, at the same time, implying the regulations which should govern us in our operative procedures."

Having thus traced the development of Modern Operative Surgery, it will be most advantageous in this introductory portion of the work, to show how Surgical Anatomy, properly so called, is modified throughout by constant association with pathological conditions, in the performance of any operation. Such an association will tend to correct the *purely* Anatomical impressions of the Student, and to safely guide the operating Surgeon.

It is only under the circumstances of disease or injury and life combined, in other words, Pathology, in conjunction with Anatomy, that the operating surgeon interferes. He is never called upon to touch the body in its healthy anatomical conditions. True, certain Operations are apparent exceptions to this otherwise unexceptional law. It may be, as I have said, that the seats of operation and of disease or injury are not identical; that our operation is somewhat removed from the diseased or injured locality. Such are amputations, and the ligature of arteries for aneurism. But even under these circumstances, pathological anatomy can alone determine whether or not we operate clear of the disease and amid healthy tissues;—whether, for example, the bone and soft parts left after amputation are healthy, and whether we cast our ligature around a healthy portion of artery. This *negative* application of pathological anatomy is obviously of the highest importance in respect to the successful results of surgical operations.

On all other occasions, the physical properties and relations of parts disclosed during an operation are then so changed by disease as sometimes scarcely to admit of recognition; and thus it is that anatomy *plus* certain pathological alterations, or the *pathologico*-anatomical conditions of the body, are those with which the operating surgeon is concerned.

Guided by this *à priori* principle, we can predicate those pathological conditions which from their nature must chiefly influence the performance of surgical operations;—alterations of certain physical properties, more especially of colour, consistence, and elasticity; also modifications of shape and size, with those affecting the situation, position, and relation of parts; such peculiarities altogether change the scene with which the mere anatomist is familiar.

Nor are these the only circumstances that overshadow the appearances to which he is accustomed. Whoever has observed the arm of a dead sub-



ject as it lay extended over the side of a dissecting-table, must have been struck with the well-marked bicipital depression, especially visible on a thin subject. If injected, the brachial artery can almost be distinguished as a prominent line throughout its course. Apparently, a single incision would bring one down upon the vessel, and so it does. The skin, gluey and adhesive, hangs upon the knife; nor does the incision gape; the artery is soon exposed, not being overlaid by the contracted biceps, and only, perhaps, obscured by the turgid vein on its inner side. Contrast all this with the same proceeding during *life*. We observe no such well-defined groove to guide our incision; the skin yields before the knife with a crimp and elastic resistance; the wound gapes; the swollen and vibratile belly of the biceps muscle, especially if amply developed, overlays the artery, while the vein, perhaps not so turgid, immediately conceals it. More or less hæmorrhage will also further obscure the vessel, which can only be recognised by its beautiful fawn-colour and its pulsating under the finger. I have purposely excluded the brachial plexus of nerves from this sketch, in order more clearly to contrast the *dead* with the *living*.

This illustration will apply, *mutatis mutandis*, to operations for the ligature of other arteries; and the experience of every practical Surgeon will supply him with the more extended application of the same principle during all other surgical operations.

We must, therefore, acknowledge also the guidance of *living* (not merely functional) conditions during the performance of surgical operations. The condition of life modifies certain physical appearances, and chiefly those affected by *pathological* anatomy. Thus, the colour, consistence, elasticity, and even the size and shape of the various parts of the body, their situation, position, and relation to contiguous parts, are presented to the Surgeon, when modified by the twofold conditions of *Disease* and *Life* combined.

These together may be termed Pathology, and not Pathological Anatomy, which represents only *dead* structural disease. PATHOLOGY,—conjoined with Anatomy,—is, therefore, our guide during surgical operations. In proportion as we are familiar with pathological conditions, by so much are we enabled to foresee, and to provide for, the peculiar appearances and conditions which the knife discloses, and to recognise them as they are successively presented in surgical operations.

Guided by this anticipatory knowledge, our operations are no longer discoveries made by dissection, but *planned* and *methodical* proceedings, conducted on known principles—in fact, an ART, based on the science of Anatomy supplemented by Pathology.

When a pupil of the late Robert Liston, I frequently witnessed, and for many years observed with care, the operations of that illustrious surgeon; and I venture to affirm, that if one circumstance more particularly contributed to the ease and elegance of his operations, it was the *suitable* (artistic) *method* on which he planned and conducted them. If I might use the expression, there was a kind of *slow-quickness* about all he did,—the former quality indicating the method he pursued, the latter resulting from its sufficiency and skilful application.

The twofold Principle I have advanced might be further elucidated by tracing the *combined* influence of disease and life on the scenes of the chief Operations of Surgery. A series of such illustrations are given in my work on “Principles,” and Pathology, with Anatomy, will be found

to govern the design and guide the performance of these and other operations generally, as described in the course of this work.

Without the knowledge of Anatomy, attired in the garb of disease and life, neither safety nor success can be attained in the planning and performance of Surgical operations. "The operator,—I would say without this knowledge, is seen agitated, miserable, trembling, hesitating in the midst of difficulties, turning round to his friends for that support which should come from within, feeling in the wound for things which he does not understand; holding consultations amid the cries of the patient (before the days of chloroform), or even retiring to consult about his case, while he lies bleeding, in great pain and awful expectation."

But, no less important in Operative Surgery, is the knowledge, chiefly Pathological, to which I would next direct attention, as mainly determining the *success* of operations.

CONDITIONS FAVOURABLE AND UNFAVOURABLE FOR OPERATION.—The selection of cases fitted for Operation should always most seriously engage the Surgeon's consideration.

The Conditions Unfavourable for any Surgical procedure being known, all other conditions may be presumed to be favourable.

*Unfavourable* conditions comprise: (1) certain states of the Patient's Health, constitutional, and local in regard to the seat of disease or injury; (2) the Hygienic conditions by which he is surrounded.

*Constitutional* conditions unfavourable for Operation, relate both to the mind and body.

Persons who are naturally of an irritable and anxious, or of a desponding, *mind*, cannot sustain a surgical operation so well as those of a tranquil and cheerful disposition. This rule holds good also in the case of persons who, from temporary circumstances, may be mentally affected in like manner. And especially unfavourable, is any despondency respecting the issue of the operation itself. This adverse influence affecting the Patient's bodily health, before and after the operation, will be alone sufficient to undermine the result of any skill on the part of the Surgeon. On the other hand, the sustaining influence of hope is well exhibited by the fatal effect produced when it is suddenly withdrawn. Sir A. Cooper tells the story in his Lectures of a poor countryman in Guy's Hospital, who, lying in bed previous to a capital operation, was asked by a student what part of the country he came from; Cornwall he replied. Then said his interrogator,—you will never see Cornwall again. Nor did he; the man never rallied.

An instance of such heartless or thoughtless indiscretion, suggests the kind of address and tact, animated by honest sympathy, with which the true Surgeon will manage his patient's mental disposition, ever fairly supporting hope as the well-spring of life.

Conditions of *bodily* health, of a constitutional character, unfavourable for Operation, are numerous. They relate to all the organs of the body, and vary in importance according to the physiological agency of the organs in maintaining life. Thus, the nervous system, the heart, lungs, digestive organs, and excretory organs, especially the kidneys and skin, have severally to be considered, and from a twofold point of view. Firstly, organic conditions must be considered, as affecting the general health, and thence the life, of the individual, when subjected to any particular surgical operation; and, secondly, they should be regarded in relation to reparation, or the reserve-power of nutrition requisite

after any operation of magnitude, and which necessarily also entails an ordeal of some duration for the system to undergo, before the health can possibly be re-established.

The state of the *nervous system* is a primary consideration. When itself naturally irritable, or when in an irritable state for the time being, this condition is peculiarly unfavourable for surgical operation. It seems to be associated with a weak circulation, and the patient is apt to sink soon after any severe surgical procedure. But the judicious administration of opium with wine, brandy, or other stimulants, will often succeed in preparing the patient for operation, and carry him or her through the critical period subsequently. Chloroform, besides preventing pain, has a specially beneficial influence in irritable nervous persons, subjected to operation for surgical disease, or when the circulation is depressed by the shock of injury.

Certain *blood-diseases* prohibit any surgical operation, otherwise than one of immediate necessity for the preservation of life. Thus, any operation of choice should be postponed when the patient is labouring under erysipelas or pyæmia. Other diseases have not a fatal tendency, yet their existence is adverse to the successful result of an operation. Such are scrofula, and the contamination of the system by malignant disease. In the latter case, an operation will be almost surely followed by a return of the disease, *in situ*, or its development in some distant part.

*Heart-disease*, and particularly fatty degeneration of this organ, should make the Surgeon consider the necessity or the advantage of any operation attended with much loss of blood or shock to the nervous system. Consequently, when the pulse is habitually feeble, irregular, and perhaps slow, the patient breathless on slight exertion, and marked with the arcus senilis; these symptoms co-existing, almost surely indicate fatty degeneration of the heart, and should warn the Surgeon that he has a bad subject to deal with.

*Lung-disease* does not seem to have so important a relation to Surgical Operations. This may, perhaps, be explained by the fact that after any severe operation, the patient being confined to bed, there is no special demand on the function of the lungs as the organs of respiration. As double organs also, one may be more or less diseased and incapacitated, and the other fulfil a double or compensatory function, and especially in the case of old-standing disease. Phthisis is an exceptionally unfavourable condition, and particularly if this disease be in an active state or in an advanced stage. The operation for fistula in ano, a disease often co-existing, should not be performed under these circumstances.

The *Digestive-organs* play a most important part with regard to the result of surgical operations, and disorders or derangements of these organs demand the most careful consideration. Obviously this is due to the necessity arising after any operation of magnitude, for an extra supply of nutritive material to meet the demands of the reparative process, a supply which implies an active state of the digestive organs incompatible with any kind of indigestion. Irritable dyspepsia, and hepatic derangement, terms not very definite, but sufficiently familiar in practice, represent the conditions which are most adverse to surgical procedures.

The *kidneys* and *skin*, as excretory organs, have a grand relation to surgical operations by purifying the blood of noxious matter, the retention of which would inevitably spoil the material requisite for reparation.



Disease of the kidneys, in the various forms of degeneration, accompanied with albuminous urine, and the retention of urea in the blood, constitutes the most unpropitious condition under which a patient can be subjected to operation. The wound is apt to undergo diffuse inflammation and sloughing, while the patient sinks rapidly from the exhaustion of blood-poisoning. This seems to arise from the local products of inflammation, thus induced, becoming absorbed, and accumulating in the blood, soon overwhelm the system beyond the endurance of life, when already oppressed by the uræmic poisoning. In this condition also, both kidneys are diseased, so that there is no chance of any relief by one organ compensating for the functional deficiency of the other, as in the case, sometimes, of the lungs.

The state of the skin must also be taken into consideration before undertaking any operation. A cool, moist, soft, perspiring skin is no less conducive to success, than a free secretion of healthy urine. Chronic diseases of the skin, such as lepra or psoriasis, involving a large extent of the cutaneous surface, had better be treated before proceeding to any surgical operation which can be postponed.

*Pregnancy* does not prohibit any surgical operation, excepting in so far as this state may thereby be itself affected. In the case of a lady advanced in pregnancy, I have removed a large slough from the abdominal wall by incision, without disturbing the course of pregnancy; but, on another occasion, in the same person, the removal of necrosed bone from the scapula, under the influence of chloroform, was followed by a miscarriage the next day.

*Obesity* is said to be, in itself, a condition very unfavourable for operation, owing to the feeble circulation in such subjects. *Old age* naturally renders an individual less able to sustain the shock of an operation, and the loss of blood; subsequently also there is less power to pull through to recovery.

*Idiosyncrasy*, or some unknown constitutional condition peculiar to the individual, may prove singularly prejudicial to the success of even a trifling operation. Thus, in one case, after removing a small fatty tumour from the abdominal wall, on the following day the adjoining integument presented a sphacelated black patch, with an abundant, thin suppurative discharge from between the lips of the incision.

*Local* conditions unfavourable for operation relate to any diseased state of the part itself, which will tend to produce an unsuccessful result. Thus, acute inflammation of a joint, for example, would be adverse to excision; and a sloughing condition of the parts involved in the flaps of an amputation, would defeat the purpose of this operation. Cancer, or disease of a malignant nature, should never be removed, unless the whole disease can be freely extirpated. Any portion beyond the reach of operation will necessarily cause a return of the disease, *in situ*; an important consideration, in addition to the question of probability as to the development of cancer in some distant part.

*Hygienic Conditions.*—Besides the state of health, constitutional and local, by which a patient may be in an unfavourable condition for operation; the hygienic circumstances in which he is placed, both before and afterwards, will much affect the probability of success. Adverse hygienic conditions comprise chiefly: Defective Diet, in quality, quantity, or in both respects; overcrowding of the sick and wounded, especially those having open and suppurating wounds, or Deficient Ventilation; Exposure

to Contagious or Infectious matter, by dressings or inhalation, as in the propagation of Hospital gangrene and erysipelas. The *minimum space* allotted to each patient in the Surgical Wards of an Hospital should be 1500 cubic feet of air to each person. And this quantity must be accompanied with change of air also, by proper ventilation.

*Preparation of Patient for Operation.*—It is scarcely necessary to observe that, on the ground of personal liberty of the subject, and legal liability of the surgeon, the consent of the patient, and of his or her immediate relatives, should first be obtained before proceeding to any surgical operation. But this rule will as necessarily admit of exceptions, according to the mental capacity, or the age of the patient; the more or less urgent nature of the case proposed for operation.

If the patient be sensible, of sound mind, and mature age; and he resolutely and persistently refuse to allow an operation of urgency to be performed; and if, moreover, his determination be backed by that of an immediate relative, as his wife; the Surgeon will have no alternative but to give up the responsibility of the case. Thus, I have seen a man die from strangulated hernia, in spite of the earnest and repeated remonstrances of the Surgeon to him, and his wife, as the strangulation proceeded to a fatal termination. On the other hand, if the patient be insensible, or imbecile, or in the case of a child or infant, and in the absence of immediate relatives or parents, the operation being an urgent one, the Surgeon will be free to act according to his own judgment.

The preparation of the patient, mentally and bodily, will consist in inspiring him with cheerful hope, and in bringing his bodily health to a quiescent condition, especially observing that the actions of the digestive organs, and of the skin and kidneys, are healthy, when time can be allowed for any such preparation. This tranquil, even state of mind and body, is that best fitted for operation. But, when no time can be permitted for any constitutional preparation, as after most severe injuries, the patient must be at once submitted to operation.

*Arrangements for Operation.*—The arrangements requisite for the efficient and convenient performance of surgical operations, relate to the Room, the Operating-table, Instruments, with other Appliances, and Assistants.

The *Room*, of convenient size, should admit a good light, an over-head or skylight being very desirable for most operations; it must be adequately warmed in cold weather, or for the performance of operations wherein the abdomen is opened and the viscera exposed, as in operating for strangulated hernia and in ovariectomy; but there should also be the means of free ventilation or change of air about the patient, when under the influence of chloroform. Besides the requisites of light, temperature, and air, an ample supply of water, warm and cold, must be at hand.

The *Operating-table* must be strong, and firm-standing (not moving on castors), of convenient height, and width only of the body, covered with blankets overlaid with india-rubber sheeting, and provided with pillows. The tables constructed for operation, as used in Hospitals, are fitted with a mechanism for raising the head and shoulders to any requisite height; and flaps are provided for leaving the legs unsupported, as for amputation, or when the nates are placed so as to rest over the end of the table, as for lithotomy, and other perineal operations. A low, firm stool will be a requisite accompaniment for these operations, to seat the operator in cutting for stone, or an assistant in holding the leg for amputation.



An Operating-chair, instead of a table, is necessary for cases wherein the patient is seated; as in operations about the face, the extraction of nasal polypi, for cleft-palate, or the removal of either jaw; also, for other operations, as amputation at the shoulder-joint, and tapping the abdomen. The chair itself, firm-standing, and high-backed to support the head, much resembles a dentist's chair. These arrangements respecting the room and table should be seen to by the Surgeon himself, when not regularly provided as in a Hospital; but the remaining provisions, as to instruments and assistants, must always be personally superintended.

The *Instruments* necessary should be well selected with regard to the nature and possible complications of the operation; and for convenience, they should be arranged on a small table or tray, in the order in which they are wanted, and placed near the Surgeon, so that he can help himself to any instrument he may require, or have it handed to him immediately by an instrument-assistant. The collection of instruments, however few, had better be covered with a towel, to conceal them from the eye of the patient when brought into the room. Sponges, of various sizes, clean and compressible, with lint and plaster, will always be provided by any well-trained nurse; but here again, the Surgeon had better see that these appliances are at hand. Any splint or other accessory requisite for application after operation, and previously prepared by the nurse or an assistant, should also be inspected. A tray containing saw-dust or sand may be placed on the floor so as to catch the blood; but this has a repulsive appearance, and it is more agreeably substituted by a piece of maroon-coloured oil-cloth under the table. The operator may be conveniently dressed, in an easy-fitting, long cut, alpaca coat, or dressing-gown.

The *Assistants* should be in number sufficient, but not superfluous, and each should have an allotted duty to perform, orderly and silently. Thus, for a capital operation, as amputation, joint-excision, or lithotomy, four, or not less than three assistants, will be required; one, specially to administer chloroform; then, in the first-named operation, another to command the main artery; a third to hold the limb in position; and a fourth to take charge of the flaps, and ligature the vessels as they are seized by the Surgeon. A fifth assistant might hand the instruments; but they are often taken up most readily by the Surgeon from the table near to him.

**ANÆSTHETICS.**—The greatest gift of God to man, through Natural Science, is, perhaps, the discovery of means for the prevention or the abolition of bodily pain. This exemption approaches the realization of that blissful hereafter, one of the Divine promises of which is, that then "there shall be no more pain."

Glimpses of the truth as now made known have appeared in various ages; but it was not until the year 1800 that Sir Humphry Davy, having himself experienced relief from pain while breathing nitrous oxide gas, suggested the possibility of employing the influence of this agent for the same purpose in surgical practice. After the lapse of nearly half a century, in 1844, the same idea occurred to Dr. Horace Wells, a dentist in Hartford, America, who underwent the extraction of a tooth without pain after inhaling the gas, and he administered it with the same effect to several of his patients; but, finding the practice uncertain, he soon abandoned it. About the same time, Dr. W. T. G. Morton of Boston, in

America, who had previously been a partner with Wells, sought of his own accord, without it would appear receiving any suggestion from him, to discover an efficient anæsthetic; and having experimented upon himself and the lower animals, he extracted a tooth painlessly from a patient, under the influence of sulphuric ether by inhalation; this event taking place on the 30th of September, 1846. He then publicly exhibited the efficacy of this agent at the Massachusetts General Hospital; and thenceforward anæsthesia in surgery became an established blessing to mankind.

It was not long ere this invaluable discovery was recognised, and followed up by farther investigation in this country; which resulted in the introduction of *chloroform*, and its employment instead of sulphuric ether. The latter agent is still extensively used as an anæsthetic in America; but in Europe, chloroform is now generally preferred to it. Disguised under the name "chloric ether," in which it exists diluted with spirit of wine, this agent was employed by Dr. Morton in his first experiment upon himself; and it is a fact, not perhaps generally known, that it was also used in the same form, in preference to sulphuric ether, by Mr. Lawrence, at St. Bartholomew's Hospital, in the summer of 1847. Mr. Paget confirmed this fact by information communicated to Mr. Lister; to whose article on anæsthetics, in *Holmes's Surgery*, I am indebted for the particulars of the foregoing historical sketch, and for much which follows on this subject.

It was in the autumn of 1847 that Dr. Simpson, who was engaged in a series of experiments with various narcotic vapours, employed for the first time the active principle of chloric ether, at the suggestion of Mr. Waldie, of the Apothecaries' Hall of Liverpool; and finding that pure chloroform had certain advantages over sulphuric ether, he zealously recommended it to the Profession, and it has since been generally used. The advantages alluded to in favour of chloroform are, that it is a more potent anæsthetic, its inhalation causes less bronchial irritation, its odour is more agreeable, it is less volatile, thereby rendering its administration more easy; and lastly, the vapour of chloroform not being inflammable like that of ether, it is fitted for operations by artificial light.

**CHLOROFORM.**—This anæsthetic agent will be briefly considered in regard to:—its physiological action; the phenomena produced by inhalation; the question of its contra-indication in certain diseased conditions of the system; the method of administration; death from chloroform; and the treatment of an over-dose.

*Physiological Action.*—The action of chloroform on the functions of the nervous system is such as to render it exactly suitable for the purposes of surgical practice. Chloroform is a narcotic, and like most medicinal agents of this class, it produces temporary excitement, followed by suspension of the functions of the nervous centres; but it affects them not simultaneously, but in a certain order. The *brain* is the first to evince loss of power, in the failure of sensation, including consciousness, and voluntary motion; the *spinal cord*, or rather the whole cerebro-spinal axis, secondly, soon loses the reflex function of involuntary excito-motion, so far as regards the voluntary muscles, which lie perfectly relaxed and passive. This combined state of insensibility to pain, paralysis of muscular action, voluntary, and involuntary with regard to the voluntary muscles, presents a condition most favourable for the performance of surgical operations. On the other hand, the *involuntary* action of the muscles engaged in respiration remains, and the action of the heart, as dependent

on the ganglia of the sympathetic nerve, continues. Thus then, while the whole physiological condition of the nervo-muscular system suits the convenience of the Surgeon, and the patient is rendered insensible to pain; those dependent functional actions are retained which are essential to life.

Certain other important advantages attend the inactivity of the cerebro-spinal centre. The shock of injury, which would be increased by the additional violence of surgical operation, is diminished under the influence of chloroform; thence, the contractile power of the heart, as affected by the action of the brain and spinal cord upon the cardiac ganglia through the medium of the pneumogastric and sympathetic nerves, is unreduced by such violence, thus averting the tendency to *cardiac syncope* and death during operation; and lastly, in the absence of faintness, the vessels bleed freely, and by at once declaring those which require ligature, the liability of *secondary hæmorrhage* is prevented. Moreover, the mental tranquillity secured before operation by the prospect of immunity from suffering, is a condition highly favourable to recovery afterwards.

*Phænomena or Symptoms* produced by the action of chloroform.—After inhalation for a time, varying considerably in different individuals, but generally of longer duration in adults who have been accustomed to the free use of narcotics, and shortest in children, symptoms of excitement are manifested by various ejaculations, and by muscular rigidity and movements requiring some restraint; but this state is soon and suddenly succeeded by complete relaxation and insensibility, accompanied with deep heavy respiration. Or, without any previous stage of excitement, the patient may at once pass into a state of tranquil sleep. The suspension of reflex action is denoted by the absence of unconscious winking when the eye-ball is touched with the tip of the finger, as a stimulus; a state commonly regarded as insensibility of the conjunctiva. The heart's action, and pulse, at first quickened and more forcible than natural, subsides under the influence of chloroform, and becomes slow and feeble or scarcely perceptible. The respiration also becomes feeble and imperfect, and the blood proportionately venous; a state approaching or bordering on asphyxia. Snoring or stertorous breathing is soon induced, passing into complete obstruction to the entrance of air into the chest, although the respiratory movements of the thoracic walls still continue. Occasionally, without any premonitory stertor, the breathing becomes more or less suddenly obstructed, and a livid turgescence overspreads the face. Death is imminent where inhalation is carried to this degree as regards either the circulation or respiration; and whether as the result of administering a highly concentrated vapour, or of long continued inhalation.

There are instances occasionally of persons who, from some peculiar idiosyncrasy of constitution, are incapable of being affected by chloroform; they are proof against its anæsthetic influence. Thus, I have known four ounces of chloroform administered to a lady, by inhalation, without producing the slightest effect.

*Contra-indications* to the employment of chloroform.—Certain constitutional conditions and organic diseases, are said to prohibit the use of chloroform, or to require extreme caution in its administration. The influence of *shock* has already been adverted to, in speaking of the physiological action of chloroform. Pain is not a stimulant but a depres-



sant, and therefore the performance of an operation during the continuance of shock, and without chloroform, would increase the collapse; and, moreover, as already explained, the influence of this agent protects the action of the heart from the tendency to cardiac syncope, resulting from the pain incident to an operation. Hence, operations may be safely performed, under the influence of chloroform, during the shock of injury; thus overturning the old rule of postponing operation, amputation for example, until the patient has recovered from the state of collapse. The system may be at once relieved from the injurious presence of a mangled limb, or life preserved where it would be hopeless to wait for returning consciousness. But, during shock, it is unnecessary to give chloroform to its full extent; but only so far as to benumb sensation in the incisions or painful part of the operation.

*Epileptic* persons may be subjected to the influence of chloroform-inhalation, administered cautiously, however, considering their liability to suffer from congestion of the brain.

*Hysterical* persons are said to be subject to laryngeal spasm, during inhalation.

*Disease of the Heart* does not absolutely contra-indicate the administration of chloroform, but only that it be given with extreme caution; watching the pulse especially, and the breathing. In *fatty degeneration* of the heart, the sedative influence of chloroform is liable to suddenly arrest the action of this organ with instant death. In *valvular* disease there is less danger.

*Disease of the Lungs* is not specially obnoxious to inhalation. In *phthisis*, not far advanced, no difficulty arises; but with bronchial irritation, troublesome cough is apt to be produced.

*Disease of the Kidneys*, resulting in degeneration of these organs, and the retention of urea in the blood, is a condition decidedly unfavourable for the administration of chloroform. Congestion of the brain being superadded to the uræmic-poisoning, may induce epileptic convulsions, with lividity of the face, stertorous breathing, and coma.

All *Surgical Operations* allow of the employment of chloroform, excepting a few in which the assistance of the patient is required, and in operations attended with copious hæmorrhage into the mouth. In some cases, however, pain may be prevented to a great extent, by giving chloroform during the earlier or more superficial parts of the operation.

*Age* is no objection to the employment of chloroform; infants and octogenarians taking it with safety.

*Administration of Chloroform.*—Prior to giving chloroform, the patient should be directed to omit taking food for four or five hours, as the presence of any food in the stomach is apt to cause troublesome vomiting during inhalation. The patient lying recumbent with the head and shoulders just comfortably elevated on a pillow, he should not be allowed to raise himself in any struggling excitement, or be raised, into the sitting posture whilst under the influence of chloroform, lest cardiac syncope take place. Any tight band around the neck or waist should be loosened, the breast had better be exposed, and care should be observed not to subject the thorax or the abdomen especially, to any compression, as the respiration becomes principally diaphragmatic.

Chloroform may be administered simply on lint or a handkerchief, or by means of an inhaler of some kind. The former mode is in general use, it being equally safe, provided only two precautions be observed;

the chloroform must not be given too suddenly, or the vapour breathed in too concentrated a state or without a free admixture of air.

The mode of administration is simply this: a piece of lint or a handkerchief folded two or three doubles, and about the size of the hand, is sprinkled with a drachm or two of chloroform; it is then held near the nostrils, but so as to admit a free admixture of air with the first few inhalations; after the lapse of about a minute, a towel may be placed over the face of the patient and the hand of the chloroformist to enclose the vapour, still observing to admit the air freely under one corner or one-half of the towel. This is continued, interrupted perhaps by the temporary excitement and struggles of the patient, until the arm falls involuntarily and relaxed when raised, and the eyelid ceases to move when the conjunctiva is touched with the finger. During the course of inhalation, the chloroformist should have his other hand on the pulse, carefully feeling its force and frequency, while at the same time he unceasingly watches the breathing. If at any moment, earlier or later, during inhalation, the pulse sinks to a feeble, slow beat; or if the breathing becomes strongly stertorous; immediately discontinue the administration of chloroform; and for the relief of the respiration, at once seize the tip of the tongue, with forceps or the fingers, and draw it firmly forwards out of the mouth, until the tendency to obstruction has subsided. The breathing returns with perfect freedom, and the overshadowing lividity of the face disappears. Chloroform can then be cautiously reapplied, if necessary.

*Inhalers* of various kinds have been devised for the purpose of regulating the proportion of chloroform and the admixture of air. Snow's inhaler, or Clover's chloroform apparatus, may be employed; and the latter is spoken of very highly by those who have used it, as being most efficient. But simplicity with efficiency is always a great recommendation, and thus the administration of chloroform by means of a piece of lint or a handkerchief can be accomplished at once, when any form of inhaler may not be at hand and would have perhaps to be fetched from a distance of some miles off. Even in Hospitals, inhalers are not commonly employed.

In point of safety, the two methods of chloroform-administration are equally available, provided only that a free admixture of air be attended to. I have seen chloroform given in some thousands of cases without an inhaler, during upwards of twenty years, both in Hospital and private practice without a single death, or even an approach to a fatal termination, when the requisite precaution for safety has been observed.

*Death from Chloroform.*—During inhalation, death may occur in three different ways: by asphyxia, by cardiac syncope, or by coma; through failure of the respiration from insufficient aëration, or by laryngeal obstruction; failure of the heart's action; or congestion of the brain.

*Asphyxia* is indicated by the ordinary symptoms: lividity and turgescence of the face, violent respiratory efforts, and cessation of the pulse, and of the heart's action. These symptoms may arise simply from deprivation of air resulting in a highly venous state of the blood; but stertorous or snoring breathing is superadded, when the asphyxia arises from laryngeal obstruction. The cause of this obstruction is generally attributed to a "falling back of the tongue," thus mechanically obstructing the entrance of air through the larynx. But Mr. Lister has specially investigated the question, and he finds that the obstruction arises from an



approximation of the apices of the arytaenoid cartilages towards, or to, the base of the epiglottis; the stertorous breathing resulting from the vibration of the corresponding portions of mucous membrane, the posterior parts of the arytaeno-epiglottidean folds. Traction of the tongue firmly forwards abolishes the obstruction and stertor, not by any mechanical action on this part of the larynx, for the base of the tongue and hyoid bone remain unmoved in position. It would appear that such traction operates by reflex action through the medium of the nervous system, but whether by inducing or relaxing muscular contraction in the larynx, is uncertain.

*Cardiac Syncope* always occurs suddenly. The patient, after a few inspirations, suddenly becomes pale and faint, the pulse beating almost imperceptibly for a few moments, and then ceasing, although the respiration may continue; death taking place by paralysis of the heart. This organ may itself be healthy, but more frequently it will be found to have undergone fatty degeneration.

*Coma* presents the same appearances as asphyxia, but without failure of the heart's action. The face becomes livid, the breathing stertorous, and the body convulsed; the heart continuing to beat up to the last, as death results from congestion of the brain. This mode of death occurs mostly in epileptics, and in persons affected with uræmic blood-poisoning from old-standing renal disease.

These three modes of death are referable generally to the incautious administration of chloroform; whether as regards an excess of chloroform in proportion to the admixture of air, or the prolonged inhalation of this anæsthetic agent.

*Persistent Sickness* is another occasional cause of death; but it occurs after the administration of chloroform, and seems to be a consequence of some idiosyncrasy of the individual. I have only known one case, death having occurred from the exhaustion of continued sickness for four days after amputation of the thigh for encephaloid cancer of the knee-joint, in the person of an otherwise apparently healthy young woman. In another case, after excision of the knee for scrofulous disease, in the person of a young woman, sickness set in and continued for a week; but it was subdued by the hypodermic injection of morphia, while life was sustained by nutritive enemata.

*Treatment of an Over-dose of Chloroform.*—The indication to be fulfilled will vary according as the symptoms, or apparent mode of death, arise from asphyxia, or from cardiac syncope; the object being to re-establish the respiration, or to stimulate and restore the heart's action and the circulation. But in either case, the following directions should be carried out immediately, and in combination:—

The administration of chloroform must at once be discontinued.

Firm traction of the tongue must be immediately had recourse to, this being effected by seizing the tip of the tongue with fingers or forceps and drawing it well forward out of the mouth.

Air must be allowed to circulate freely around the patient, by opening the nearest window and the withdrawal of bystanders.

The chest exposed and free of constriction, should be whipped or flagellated with a wet towel in order to stimulate reflex respiratory action.

This failing, artificial respiration should be resorted to; the best mode being compression with the hands just below the sternum, by a sort of

sharp concussive jerk, followed by relaxation for expansion of the thorax, while the tongue is still drawn out of the mouth.

Electricity may be employed as the last resource, by applying one pole of a galvanic battery over the spinous processes of the upper cervical vertebrae and the other to the præcordial region, so as to stimulate the respiratory and cardiac ganglia.

Friction of the extremities, and bottles or cans of hot water to the feet, may also be used, to promote the general circulation.

These means of resuscitation should be continued perseveringly while any sign of vitality remains, for it has happened that a patient apparently irrecoverably dead has thus at length been restored to life.

*Bichloride of Methylene* and *Chloral* are anæsthetic agents which have recently been added to those already noticed—nitrous oxide gas, sulphuric ether, and chloroform. For this addition we are indebted to the experimental researches of Dr. B. W. Richardson.

Bichloride of Methylene has, Dr. Richardson states, been administered at present (Oct. 1869) to between six and seven thousand persons with only one fatal termination. It occurred in a patient of Mr. Canton's, on whom he was about reluctantly to operate at Charing-Cross Hospital, for advanced malignant disease of the upper jaw. The patient, a man thirty-nine years of age, was previously exhausted, bodily and mentally, by great suffering of three months' duration, the apparent date of the disease; one nostril was closed by the tumour, thus obstructing respiration, and the patient was subjected to the influence of the bichloride in a sitting posture. One drachm and a half, in separate quantities, had been administered, when the man's head fell back, the pulse became feeble, and then ceased. There was no accompanying stertor nor lividity of countenance. The horizontal position, artificial respiration, and galvanism, failed to restore life.

Chloral is, by some observers, said to possess powerful anæsthetic properties; others deny that it is an hypnotic or anæsthetic, but regard it as a powerful excitant.

**LOCAL ANÆSTHESIA.**—The application of cold to a part of the body, in order to reduce the temperature of that part to a frost-bitten condition, is a mode of anæsthesia which may be advantageously employed in certain surgical operations. It is eligible in all superficial and limited operations, in regard both to their extent and the time requisite for their performance. Such are, the avulsion of a toe-nail, puncturing abscesses, slitting up fistulæ, and the excision of small tumours.

Freezing of the part operated on may be effected either by the application of a frigorific mixture, as introduced by Dr. J. Arnott, or by the ether-spray, devised by Dr. B. W. Richardson.

The frigorific mixture of pounded ice and salt is easily made, and answers admirably. This mixture is put into a muslin bag, and applied to the part, being raised in a minute or two to see whether the desired effect has taken place. The skin almost immediately loses its colour and becomes white, a change the more observable when previously reddened by inflammation; but this blanching of the skin is no sign of freezing having occurred; soon, however, a dead white, opaque spot appears, quickly spreading over the cutaneous surface, and then the part is frozen and anæsthesia produced. The integument cuts hard, like parchment, and the blood is singularly florid. Reaction speedily sets in, and the part recovers itself. No constitutional disturbance accompanies, or ensues

from, this freezing of a part of the body. I have seen or known only one case of any unfavourable consequence. The patient, a healthy, florid young woman, had sat and seen me remove one of her great toe-nails, looking at the operation with perfect indifference; but when reaction took place, she suddenly fainted, and again and again, until the syncope was alarming.

The *Ether-spray* is another means of freezing a part and inducing local anæsthesia; but in this method it is effected by evaporation of ether thrown upon the surface in the form of a fine spray from a little apparatus contrived by Dr. Richardson for the purpose. It offers a more ready method for the convenience of surgical practice, as it may always be kept at hand; whereas ice cannot always be obtained. Unfortunately, so far as my experience has gone, the apparatus, simple in itself, usually seems to be out of working order when wanted.

DANGERS ATTENDING, OR CONSEQUENT ON, SURGICAL OPERATION.—The perils pertaining to operation are principally as follows:—(1) Hæmorrhage, primary and secondary; (2) Shock; (3) Tetanus; (4) Inflammation; (5) Gangrene; (6) Erysipelas; (7) Pyæmia. Of these different contingencies, some are coincident with, others consequent on, the operation. They will all be fully considered in various chapters of this work.

DRESSING OF THE WOUND, AND CONSTITUTIONAL AFTER-TREATMENT.—The dressing of a wound made by surgical operation is the same as that of any incised wound; and the dressings will vary with the supervention of inflammation, and its consequences—Suppuration, Gangrene, and Ulceration. The Constitutional After-treatment must have reference to the various states of the system in the contingencies already alluded to; and to those resulting from inflammation—namely, Inflammatory Fever, Hectic, and Gangrenous-typhoid febrile disturbance. All these states also are considered in their appropriate chapters.

RESULTS OF OPERATION.—The object or purpose of any Surgical procedure should be viewed with regard both to its temporary and its permanent results. An operation may be successful from the one point of view, but not from the other.

The unsuccessful results of any Surgical procedure may, perhaps, be reduced to three general heads:—(1) A return of the original condition for which the operation was performed; (2) the substitution of some new condition, not better, or worse, than the first; (3) the inducement of disease in some distant part of the body. Of the two first modes of unsuccessful results, such instances may be cited, as, after amputation of a limb, the return of gangrene in the stump; after excision of a joint, the substitution of a useless limb. The third mode of unsuccessful result is illustrated, after ligature of an artery for aneurism, by the development of aneurism in another part; or after the excision of cancer-growth, the development of internal cancer.

# PART I.

## GENERAL PATHOLOGY AND SURGERY.

---

### DISEASES OF NUTRITION.

---

#### CHAPTER I.

##### INFLAMMATION.

INFLAMMATION may be defined to be a modification of Nutrition; consisting, essentially, in an increased textural productiveness and destruction of texture, and *acceleration*, therefore, of the nutritive process; resulting in an accumulation of mixed, organized matter,—partly, of products, having an imperfect structural homology or resemblance to healthy conditions of texture or textural elements, and partly, of *débris* or waste of the textures involved. In connexion with this process of accelerated and imperfect nutrition, the local circulation of blood, and the containing vessels, undergo certain changes; an increased flow or *determination* of arterial blood to, and in, the capillary vessels, at the seat of inflammation, stagnation and accumulation or *congestion* of blood in the capillaries of the inflamed part, the veins transmitting the increased current of blood through collateral capillaries—with enlargement of all the vessels concerned,—vascular changes which are accompanied with an effusion or exudation of organizable plasma or liquor sanguinis. The condition of the local circulation in the capillaries is known as the *stasis* of the circulation in an inflamed part.

This complex process has the most comprehensive significance, both pathological and practical; having relation to all Injuries, Diseases, and Surgical Operations. Hence, a due knowledge of Inflammation and its consequences, is of primary importance in the study of Surgery.

The pathology of Inflammation is most appropriately introduced by a brief consideration of the physiology of healthy Nutrition,—in the maintenance of the structural integrity of the body, and the modifications of this process in growth and development.

NUTRITION is that process, wherein the blood or its constituents as nutritive material—liquor sanguinis, plasma or blastema, is converted into the various textures and organs of the body; thereby restoring or repairing the loss or waste of their structure, which continually accompanies the exercise of their respective functions. The changes which the nutritive material undergoes are of two kinds:—chemical, in respect to its composition, plastic or formative, as productive of structure; analogous but opposite changes taking place in the course of decomposition and destruction of the textures.

In any diseased modification of Nutrition, as Inflammation, the process



is essentially the same in kind, differing only in degree. Hence, the products or structural results, and their appearances in course of destruction, are the same, differing only in character. Parallel, but apparently less definite, modifications of chemical composition, may be inferred.

The process of Nutrition may be traced, to some extent, in certain tissues, which, being situated on the surface of the body, are open to observation. Epidermic tissues, namely, scarf-skin or cuticle, nails and hairs, are thus patent. The cuticle, for example, is a layer of cells overlying the vascular and sensitive true skin. From the latter, a thin, and nearly transparent, serous fluid perpetually exudes, and in this, as a nutritive plasma or blastema, the cuticular cells are formed.

Let a portion of cuticle be removed by a blister or a slight burn; the exposed surface is found to be constantly bathed with this fluid. If lightly sponged dry, the surface immediately perspires, as it were, and moistens again. The cells, first formed in this fluid, are soft and round, as seen under the microscope, in newly-formed cuticle. They are also soluble in acetic acid. They give place to similar cells underneath, and as the first formed pass upwards from the true skin, they become dry, hard, and flattened, and acquire the characters of ordinary scaly epithelium; which eventually disintegrates and desquamates from off the surface of the body. A chemical change also accompanies the maturation and destruction of cuticular cells; in this stage, they are insoluble in acetic acid.

This twofold process—formative and destructive—is ever going on; the cuticle being produced, and reduced more or less perceptibly by the decay, death, and shedding of the cuticular cells; they having previously served their function of protecting the subjacent true skin.

Molecular disintegration and death, by the constant exercise of function, may be inferred, if not seen, to be proceeding in all other tissues. But constant waste, thus induced, implies constant repair, and the reparative material can only come from the blood. This vital fluid must, therefore, present an appropriate composition for the repair of each component tissue of the body, and must also be supplied in adequate quantity thereto, as all the tissues are alike undergoing incessant destruction.

Assuming this twofold condition of quality and quantity of blood, due to the tissues severally; they, on their part, select and secrete or separate from the blood-vascular system, as the common reservoir, that kind and quantity of plasma which is appropriate for their individual nutritive maintenance. The blood is thus left reduced in quantity, and, moreover, deprived of those constituents which have entered into the formation of the tissues. But, as each tissue draws its own particular nourishment, the residual mass of blood, in circulation, becomes relatively adapted, in quality, for the proper nourishment of other tissues, of dissimilar composition. The tissues, severally, in their functional relation to blood-elaboration, are thus excreting organs.

The blood is renewed in quantity, and further maintained in quality, by the co-operation of other functions,—digestion, excretive secretion, and respiration; while its circulation is regulated by the agency of the nervous system. Again and again is this fluid, replenished and renovated, distributed to every part of the body, each tissue claiming and retaining that quantity of the common pabulum which may be necessary, and selecting those ingredients which enter into its own formation, to repair its waste and thus maintain its substance.

*Growth and Development.*—It will be obvious that any increased



nutritive demand, beyond that of mere maintenance—as by Growth, necessarily implies at least an increased supply of blood to the part undergoing this change, and perhaps also a different quality of blood to meet any such additional requirement. Indeed, ever moving and vibrative as are the leaves of an aspen tree even on a breathless summer's day, so likewise oscillatory is the nice adjustment and equilibrium of nutrition. The balance of maintenance could never be continued from hour to hour, scarcely from minute to minute, without a varying capacity in the circulatory system to satisfy ever-varying demands. This provision would seem to be brought into action by nervous influence. For, not a sensation thrilling, not a thought inspiring, not an emotion agitating ever so gently, but forthwith there is a flush of arterial blood with life-giving energy; manifesting the wide-spreading agency of the nervous system. In some instances, this rush of blood is visible, as in blushing. By analogy, it is probable that any act of volition in like manner relaxes and enlarges the capillary vessels of the muscle or muscles to which it is directed, through the medium of the nervi-vasorum. The flow of nervous influence, or vis nervosa, which excites contraction of the voluntary muscular fibres, would thus simultaneously relax the involuntary fibres of the smaller vessels. The waste of muscular tissue incurred by each slight momentary movement, and, therefore, more so by continued exercise, would consequently be repaired by an adequate flow of blood. Proportionate also to the act of volition as is the exercise and accompanying waste, so also may be the enlargement of the nutrient vessels, and consequent flow, or supply, of blood. Determination of blood it might then be called. But, this influence of the nervous system by volition is a physiological probability only, not a fact, as yet actually demonstrated.

*Development* contrasts with growth, in representing the quality, as well as quantity, of structure produced. But the two are concurrent and co-equal manifestations of the formative power, in healthy Nutrition.

It would appear that emotional influence is not limited to apportioning the supply of blood, and thence the quantity of growth or the size attained by a part subject to such influence; the *quality* or kind of growth produced, is also, in a measure, regulated thereby. For example, a fatty tumour was removed by Mr. Lawrence, several years ago, from a woman's shoulder; and when the wound had healed soundly, she imagined the tumour to have been a cancer, and that it would return. By accident, Mr. Paget saw her some months afterwards, and she had a large and firm painful tumour in her breast, which was not removed, for its nature was obscure and her general health unfavourable. Some months subsequently, having become Mr. Paget's patient at the Finsbury Dispensary, her health had much improved, but the hard lump in her breast still remained, as large as an egg, and just like a portion of indurated mammary gland. She was assured by Mr. Paget that her supposed cancer would disappear; and it did become very much smaller, without any help from medicine. As this tumour had arisen under the influence of fear, so it very nearly subsided under that of confidence. The patient was lost sight of before the tumour had been completely absorbed.

In this summary of the process of Nutrition, we observe a co-operative relation subsisting between its essential conditions:—textural changes; and the blood, in quality and quantity, as representing the nutritive material; accessory to which are the blood-vessels which convey the blood to the part nourished; and the nerves in connexion therewith,

which further regulate the supply. The accessory character of the two latter conditions is also evinced by the fact of Nutrition taking place in comparatively avascular textures, and those which are destitute of nerves; as cartilage. Thus then is Nutrition maintained; and we also observe in these conditions adequate provision for the extra demands of Growth and Development, whereby blood is duly determined to textures or parts undergoing this twofold physiological change.

*Repair* of texture, after destruction by injury or disease, is subject to the same conditions. The processes of primary adhesion, immediate union, suppurative granulation,—with perhaps secondary adhesion, and scabbing, as described in subsequent chapters, may therefore be properly associated with this general consideration of the physiology of Nutrition.

INFLAMMATION is another modification of Nutrition, the same elements co-operating. This process can be observed when it takes place in textures on the surface of the body, as the skin; and it is best illustrated when occasioned simply by a burn or other injury, rather than when induced by the operation of a blood-poison, as in erysipelas, boil, or carbuncle; which are specific and complicated illustrations of inflammation.

(1) *Textural Changes*.—The twofold nature of the textural changes in Inflammation, is the same as in healthy Nutrition; but the textural productiveness and the destruction of texture, are both increased, and the process proceeds more rapidly. Hence, the products are not only increased in quantity, they are also imperfect structural conditions of textural elements, by various degrees of arrest of their development; such as exudation and pus-corpuscles, coagulated fibrin with plastic corpuscles, granular matter, and serum; while the débris or waste matter of the texture is apt to accumulate.

In virtue of its increased productiveness, inflammation differs from nutritive-maintenance, and is allied to growth; but in virtue of its rapidity, the process is so hurried on, that more is accomplished in a given time, and consequently the products are imperfectly developed. Accelerated Nutrition would therefore seem to be an appropriate name for Inflammation, as at once expressing its nature and distinctive character.

(2) *State of the circulation of blood*, and of the *blood-vessels*, in relation to, and in, the part inflamed.—This element of inflammation necessarily pertains to vascular textures; nevertheless, comparatively avascular textures, such as cartilage, which are nourished by imbibition, are affected by the circulation of blood in the adjoining texture, whence they derive their nutritive material as the source of supply.

The blood current to, and from, an inflamed part, through the arteries and veins respectively, is increased in quantity, force, and rapidity; so also it would appear to be primarily increased in the capillaries of the part, but secondarily it becomes stagnant, a condition known as the *stasis* of the circulation in those vessels. The arteries, veins, and capillaries all apparently become enlarged.

Enlargement of the arteries, with increased flow of arterial blood through them, constitutes *determination* of blood; enlargement of the capillaries, with stagnation or accumulation of blood in them, constitutes *congestion* of blood; the enlarged veins transmitting the increased current of blood, through collateral capillaries.

In inflammation, the presence of determination of blood, subsequently of congestion, and possibly the co-existence of both these vascular con-

ditions, are facts, which have been more or less established by the following experimental observations.

(a) *Arterial and Venous Circulation*.—The arteries towards an inflamed part throb with increased pulsation, while the veins therefrom are turgid. It might appear that the former are beating with blood apparently rebounding from some obstruction in advance, and that the latter become turgid with stagnant blood. But experimental observations demonstrate the accelerated rapidity and force of the blood's motion to, and from, an inflamed part.

Let an artery toward a part inflamed be divided, and the blood is seen to be ejected to a much greater distance than that from an artery of the same size and distance from the heart, but not contiguous to an inflamed part.

This increased propulsion was noticed by Dr. John Thomson,\* when the arteries of a finger were divided in whitlow, and when those of the prepuce, much inflamed, were cut in the operation for phymosis. More exact, because comparative and otherwise complete, was the observation of Mr. Lawrence.† One hand of a patient being inflamed, venesection was performed, at the same time, and in a similar manner, in both arms: the vein from the inflamed hand yielded about three times more blood in a given time than the vein from the uninflamed hand. The blood's motion from the part was increased.

Enlargement of the arteries leading to an inflamed part, in the human subject, is rendered probable by Hunter's well-known experiment on a rabbit. Hunter froze the ear of a rabbit, and thawed it again; acute inflammation began, with increased heat, and considerable thickening of the part. The rabbit was killed when its ear was at the height of inflammation. The head was then injected, and the two ears were removed and dried. The uninflamed ear dried clear and transparent; its vessels were distinctly seen ramifying through its substance; but the inflamed ear dried thicker and more opaque, and its arteries were considerably larger.

(b) *Capillary Circulation*.—The state of the capillary circulation in inflammation, and the condition of stagnation or stasis, has been observed in the transparent parts of certain animals, chiefly in the web of the frog's foot, and in the bat's wing. Conclusions drawn from such data relative to the human organism, are inferential only, the physiological and structural conditions being dissimilar. Yet these inferential conclusions represent the remainder of what is known respecting the nature of inflammation, in the human subject.

Determination and congestion of blood, are, according to some observers, said to co-exist at the seat of inflammation. Dr. C. J. B. Williams maintains this view; and also that the resulting compound state-inflammation may originate either in determination or in congestion, or in the concurrence of both simultaneously.

To illustrate the origin of inflammation by the concurrence of determination of blood and congestion, Dr. Williams adduces observations made on the web of the frog's foot. "If," says he, "a strong irritant, as a grain of capsicum, or a minute globule of essential oil, be applied to the web, all its blood-vessels speedily become enlarged; those most irritated

\* Lectures on Inflammation, 1813, p. 67.

† Lond. Med. Gaz., vol. v., 1829.



are very large and red, and the blood in them is stagnant and coagulated, contiguous vessels are also very large, but less red, and the motion of the blood in them is slow, and often in pulses or oscillations; whilst in vessels beyond, the enlargement of the capillaries is less considerable, but that of the arteries is obvious, and the current of blood is very rapid."\*

This state of co-existing congestion and determination of blood, as resulting from over-irritation of the web of a frog's foot, may be inferred to occur also in the human subject. But in other animals than the frog, congestion occasioned by venous obstruction, produced artificially, actually averts determination of blood: therefore, experimental observation equally justifies the inference, that diminished motion of blood cannot be, in the human subject, an essential part of inflammation—a process which certainly implies determination.

Thus, the experiments of Macartney appear to me conclusive evidence that determination of blood is prevented in rabbits by congestion arising from venous obstruction. The most remarkable circumstance, observes this authority, with respect to congestion, and the one which has not hitherto been described, is that arteries found in a congested part are smaller than their natural size.

Both the jugular veins of a rabbit were ligatured; the animal died apoplectic, and upon examining the vessels of the ears, the veins which lie towards their outer edge were found greatly enlarged and gorged with dark blood; but the artery which runs in the centre of the ear was reduced very much below its natural size, so that it appeared as a mere line.

Another experiment showed the instantaneous effect of arresting the venous circulation. The mesentery of a young rabbit was exposed, and the trunks of several mesenteric veins having been tied, their corresponding arteries contracted immediately in the most palpable manner and to a very small size, as if, significantly adds Macartney, taught by their organic instinct that blood should not be permitted to go where it must immediately return.\*

The causes of congestion of the capillaries in inflammation, are said to consist in the state of these vessels, and of their contained blood; the former becoming dilated, lengthened, and tortuous, as the result of their weakness and inelasticity from over-irritation; the latter being an impacted state of the red-corpuscles, and increased production of the pale-corpuscles, which are also more adhesive than in health, and cling to the sides of the vessels.

But, equally untrustworthy as are experiments on the frog's foot, the bat's wing, and other transparent parts of animals, to determine whether congestion be an element of inflammation in the human subject, are similar observations to ascertain the condition of the capillary vessels and of their contents in the state of inflammation.

Assuming the experimental observations of Dr. Williams on the web of the frog's foot to be accurate, the dilatation, lengthening, and tortuosity which he describes in respect of these vessels, are at the best but data for conclusions, indirectly—grounds of probability only—as to the condition of the capillaries during inflammation in any part of the human body. No one has ever seen the appearances of the capillaries in the human sub-

\* On Inflammation, 1838, p. 141.

ject, either during inflammation or in the healthy living condition; nor can we follow with faith in the assumption that because red blood-discs become impacted, and white blood-corpuscles are apparently more abundantly developed and more adhesive than usual, clinging and lingering round and round on the walls of capillary vessels in the web of the frog's foot; therefore there is a similar blockade of these discs and waltzing of these corpuscles in the capillaries—say of the conjunctiva of the human eye when inflamed. In point of fact, the capillary circulation of a warm-blooded animal under the same circumstances does not present these appearances. Paget and Wharton Jones both watched and failed to discover any undue display of white corpuscles in the bat's wing, and the former authority attributes the large proportion of these corpuscles noticed in the frog to an unhealthy condition of this animal.

According to Professor Lister's experiments, inflammation consists apparently of a series of changes, in order as follows:—(1) A suspension of the concurrent exercise of function among the minute elements of the tissue. (2) Derangement of the blood, which, in the vicinity of the impaired tissue elements tends to assume the same character as blood always acquires when in contact with ordinary solid matter, and which renders it unfit for transmission through the blood-vessels. A return of the tissue elements to their usually active state will be associated with a restoration of the blood to a condition fitted for circulation. (3) The arteries are narrowed, and the blood flows through them with greater rapidity. (4) The same vessels subsequently become enlarged, and the current of blood is slower, although uniform. (5) The flow of blood becomes irregular. (6) All motion of the blood ceases, and complete stagnation ensues. (7) The liquor sanguinis may be exuded through the walls of the blood-vessels, sometimes accompanied by the extravasation of blood-corpuscles, owing to rupture of the capillaries.

In tracing the process of Inflammation, it is difficult to determine the order of succession in the changes which essentially constitute this process. The question of priority, therefore, on the part of the textures or the blood, is doubtful. Whether an increased textural productiveness and consequent demand for nutritive material, induces an extra flow of arterial blood towards this focus of accelerated nutrition; or whether a determination of blood solicits the formative power of the textures to more active, albeit abortive operation?

The latter view, originally advocated by John Hunter, long held undisputed acknowledgment in the schools and in medical literature; before the textures were discovered, so to speak, by Bichat, and before the grand and fertile theory of cell-development introduced by Schwann and Schleiden. But the independent vitality of the textures in relation to the blood, a physiological doctrine probably entertained by Haller, was subsequently extended to pathology by Hebreustreit, Burdach, Alison, and others; while, in respect to Inflammation especially, this doctrine is strenuously advocated with great originality of argument by Virchow,\* and exclusively adopted by Mr. Simon,† and other pathologists in recent works.

For the discussion of any other doubtful points respecting the intimate nature of Inflammation, and more particularly as investigated in animals,

\* Cellular Pathology. Trans. by F. Chance, 1860.

† System of Surgery. Ed. by T. Holmes, 1860, vol. i, p. 6.



the reader is referred to abundant sources of interesting information in the writings of Wilson Philips, Kaltenbrunner, Gerber, Gendrin, Müller, Lebert, Alison, Henle, Addison, Gulliver, Wharton Jones, C. J. B. Williams, Bennett, Paget, and Joseph Lister.

*Signs.*—The local signs of inflammation are redness, heat, swelling, and pain; the first three being objective phenomena, pain, a subjective symptom, and there is also some functional disturbance or loss of functional power in the part affected.

(1) *Redness* is a sign of inflammation, owing to the determination of arterial blood; but the development of this sign will be proportionate to the number of capillary vessels pervading the part, and the extra flow of blood through them. The colour, a florid hue, varies according to the arterial or venous character of the blood, and as shaded by any intervening texture; or it may be entirely unseen through the depth of integument concealing the engorged vessels. Their engorgement, or hyperæmia, presents different shapes, according to the peculiar anatomical arrangements of the capillaries in the texture or part. Hence punctiform, stellate, arborescent, maculiform, or spotted, and uniform blush-redness, are frequently recognised, as in the skin and mucous membranes which are open to inspection.

Redness, such as I have described, is the earliest announcement of inflammation, and also its most exact indication, being invariably present, even when unseen, a sign of no other kind of hyperæmia, and the measure of its own. The exceptional case of a growing part—*e.g.*, the gravid uterus, having similar redness, scarcely invalidates the general fact that this sign is, otherwise, peculiar to inflammation. Nor does its exceptional absence in extra-vascular tissues—*e.g.*, cartilage and the cornea, affect the otherwise general constancy of this concomitant hyperæmia. Even in such cases the adjoining textures exhibit its characteristic appearance, as by a zone of redness around the cornea, in corneitis, and increased vascularity of the adjoining bone, in inflammation of cartilage. In either case, the seat of hyperæmia coincides with the capillary plexus which is subservient to the healthy nutrition of the part inflamed.

Redness from the development of new vessels in an inflamed part is not an early occurrence, but a consequence of the process of inflammation.

(2) *Heat* is another local sign, partly due to the determination of blood; as such it is proportionate thereto, and to the number of vessels through which the extra supply of arterial blood is passing. But the increase of temperature will be perceptible only according to the superficial situation of the inflamed part, and the facility with which heat is transmitted through any intervening textures.

Is heat generated by inflammation? The flow of arterial blood, and therefore of red blood-corpuscles charged with oxygen, may possibly generate heat. Yet the experiments of John Hunter show that the temperature of an inflamed part never rises more than two or three degrees, and scarcely, if ever, above the average heat of arterial blood—say, from ninety-eight to one hundred degrees Fah. On the other hand, the more recent “thermo-electric” observations of Mr. Simon\* and Dr. E. Montgomery are apparently conclusive on this point—that an inflamed part is

\* System of Surgery, edited by T. Holmes, 1860. Vol. i., Inflammation, by J. Simon, p. 42.

no mere passive recipient of heat, but is itself actively calorific. For among the observed results are these:—

“That the arterial blood supplied to an inflamed limb is found less warm than the focus of inflammation itself.

“That the venous blood returning from an inflamed limb, though found less warm than the focus of inflammation, is found warmer than the arterial blood supplied to the limb; and

“That the venous blood returning from an inflamed limb is found warmer than the corresponding current on the opposite side of the body.”

Granting, then, that the inflammatory process unquestionably involves a local production of heat, “to interpret this fact,” adds Mr. Simon, “is perhaps, in the present state of physics, not possible.”

Whatever be the source of increased heat, it continues with the inflammation, unlike the transient warmth of blushing, or other non-inflammatory determination of blood.

Respecting its diagnostic value, the increased heat arises at the same time as the redness; it is an equally early, if not an equally exact sign of inflammation.

(3) *Swelling*.—The persistence of inflammatory determination of blood is accompanied with the appearance of lymph and serum, and consequent swelling in a greater or less degree; unlike the issue of that temporary distension of the vessels, which ordinary determination of blood denotes.

By this persistent increased flow of blood, the surcharged vessels would appear to be gradually relieved by effusion of the liquor sanguinis.

Virchow\* ventures to advance the hypothesis, “somewhat bold perhaps, though perfectly able to sustain discussion: that, fibrin generally, wherever it occurs in the body external to the blood, is not to be regarded as an excretion from the blood, but as a local production. Nobody,” he alleges, “has ever been able by the production of a mere change in the force of the current of the blood to induce the fibrin to transude directly, as it is wont to do in certain inflammatory processes; for this some irritation is always required.” Accordingly, in respect of inflammation, Virchow regards fibrin, not as an exudation or effusion from the vessels by persistent (inflammatory) determination of blood, but as “an educt from the vessels, in consequence of the activity of the histological elements themselves.”† Professor Bennett‡ suggests that the tissues attract the fibrin, which, however, pre-exists in the blood.

The engorged vessels themselves occasion some degree of swelling of the part; an increase proportionate to the vascularity of the part, and to the degree of turgescence of its vessels. Full-blooded internal organs become most swollen in this way, such are the lungs, liver, spleen, and kidneys when inflamed. But with persistent engorgement further enlargement ensues by effusion, and the situation, size, shape, and physical characters generally of this swelling, will, for the most part, depend on the kind of structure in which it takes place.

Liquor sanguinis is readily effused into the constituent cellular texture of the organ, or part inflamed, and therefore most readily into the substance of loosely parenchymatous organs; frequently, moreover, the most vascular, such as those just enumerated. Lymph and serum overflow into

\* Cellular Pathology. Trans. for Syd. Soc. by F. Chance, 1860, p. 162.

† Ibid., p. 386.

‡ Clin. Lectures on Medicine, 1858, p. 133.

cavities—*e.g.*, into serous membranes and synovial sacs. These and similar structures solicit the overloaded vessels to relieve themselves, and their size becomes enlarged, in a corresponding measure, by inflammation. Witness hepatized lungs from pneumonia in its second stage—immense enlargement of the liver from chronic inflammation; enormous increase of the spleen, forming the ague-cake by an analogous process; and the immense size to which the kidneys attain by chronic nephritis and Bright's disease. Phlegmonous erysipelas—engaging, as it does, the subcutaneous cellular tissue deeper and deeper—is characterized by considerable swelling. Witness the opposite results in tight unyielding textures—such as effusion beneath fasciæ and in fibrous textures generally, and an abscess formed in the substance of bone, but unattended with any perceptible swelling, and suspected only by the intense and unremitting pain it occasions. Certain textures allow of an intermediate amount of swelling between the extremes presented by cellular and fibrous tissues. Such are the degrees peculiar to the skin and mucous membranes. Of the latter I may mention pulpy thickening of the large intestine in cases of chronic dysentery, while swelling in some measure of the skin is one feature of most of its eruptions, however otherwise diversified their appearance may be—as rashes, scales, papules (pimples), vesicles, pustules; and most conspicuously this is the character of solid tubercular swellings, such as occur in secondary syphilis.

The shape of inflammatory swelling is also a mixed result, principally due to the kind of structure into which effusion takes place; partly, however, to the kind of matter effused. If thin serum, the swelling will be fluid, fluctuating, and diffused; if coagulating lymph be poured out, it will be more solid and circumscribed. I shall not attempt to describe the various degrees of density or consistence which inflammatory swelling presents, as resulting from the combined influence of the kind of matter effused, and that of the receiving structure. These alterations may be of two kinds: softening, chiefly in connexion with acute inflammation, and induration, chiefly in consequence of chronic inflammation.

The diagnostic value of inflammatory swelling is not equal to that of redness. It is necessarily a later sign than redness, which always precedes effusion by an important and often appreciable period of time. Iritis is announced by injection of the ciliary arteries and a zone of redness around the iris, before the perilous effusion of lymph. Erysipelas spreads with a red blush before the disorganizing engorgement of the subcutaneous cellular tissue. Regarded as an exact sign, although some degree of swelling invariably follows inflammatory determination of blood, and although the nature of an obscure swelling is assured, if not by its physical properties, at least by puncture, and if necessary by further examination with the microscope of the material of the swelling; yet these guarantees of identity are the only unequivocal advantages of this sign. Unlike redness, it is no measure of the degree of inflammation. The most intense may produce a trivial swelling in an unyielding texture, and a trivial degree of inflammation will soon exhibit considerable swelling in a loose tissue.

Subject to these disqualifications, swelling is the more valuable sign, practically speaking, of inflammation. It can be discovered when the redness cannot be seen. In all superficial textures and parts, swelling can be readily detected. The skin, cellular texture, muscles, periosteum, bone, blood-vessels, and lymphatics, and the component tissues of the



joints severally present each a characteristic swelling when inflamed. Certain internal organs are also open to examination—*e.g.*, the pelvic viscera, excepting the bladder. Thus, inflammatory enlargement of the prostate, or the uterus, and thickening of the rectum, can be felt, and possibly seen. Certain other organs are indeed beyond the reach of vision and the direct application of the hand, yet the ear can then detect effusion and swelling by means of percussion, as of the liver, gastrointestinal canal, and spleen; and this may be aided by auscultation, as of the heart and lungs.

(4) *Pain*.—Observe, the influence of swelling. No sooner has the first contribution toward swelling been made by persisting distension of the vessels of the inflamed part, than pain, or at least exalted sensibility, is induced by the blood's influence on the nerves of that part. The degree of pain from this cause will be regulated by both the elements which determine the amount of hyperæmia, that is to say will be proportionate to the determination of blood, and the number of vessels in the part; but the number of sensory nerves affected will further apportion the degree of pain. As swelling ensues from effusion, the same conditions which represent the degree of tension, will also measure the intensity of the pain. Thus a more solid, and therefore circumscribed effusion of coagulating lymph, underneath an unyielding texture, such as a fibrous membrane—*e.g.*, the fascia-lata, or a fluid similarly circumstanced, as an abscess in the substance of bone, are aggravating conditions inducing the most severe and unremitting pain; while a more fluid serous effusion into a loose texture such as the cellular tissue, say of the arm-pit, allows of a more considerable accumulation without much pain, and will then be more tolerable. Pain is also attributed to structural change in the nerve-fibrils of the inflamed part. (Simon).

The character as well as the degree of pain accompanying inflammation, is equally diversified. A burning pain in erysipelas, whence the popular name of this disease—St. Anthony's-fire. A scalding pain in inflammation of the rectum, during evacuation of the fæces. Chronic rheumatism and lumbago are attended with the dull aching pain of inflamed fibrous and muscular tissues; gout, with a wrenching pain; abscess in bone, with an unremitting burrowing pain; inflammation of the dental periosteum-periodontitis, with a throbbing pain. In other parts this character of pain is the known forerunner of suppuration. Parts endowed with but little sensibility in health, generally become acutely sensible when inflamed; as fibrous textures and bone, including the teeth; the intestinal canal in enteritis, the pleura and peritoneum respectively, when inflamed. Parenchymatous organs likewise acquire exalted sensibility, as manifested by the heavy, oppressive pain of pneumonia. Organs of special sense are for a time quickened by inflammation, and convey their own sensations but too keenly. The ear becomes too susceptible of sound, and iritis begets intolerance of light.

*Reflected* pains in distant parts are not uncommon symptoms of inflammation. Pain in the inner side of the knee may emanate from inflammation of the hip-joint; in the glans penis, from cystitis; in the testicle, from nephritis; under the right shoulder-blade, from hepatitis; and under the left scapula from gastritis. Reflex motions may be excited in like manner: Sneezing, by catarrh; coughing, by bronchitis and pneumonia; vomiting, by gastritis: and (reflex?) micturition, by cystitis.

The diagnostic value of pain is comparatively little. The pain of inflammation being chiefly due to swelling, is scarcely an earlier sign. It is also the most inexact sign; pain may be absent in true inflammation, and present without; and is rather a measure of the kind of swelling than of the degree of inflammation. By itself, therefore, pain has little diagnostic importance.

(5) The *function* of the organ or texture affected, undergoes certain changes, which constitute additional local symptoms of inflammation. They may be described in general terms, as exaltation of function, followed by its depression, and various perversions of function having an intermediate character. Thus, with inflammation of the brain; delirium, increased sensibility and convulsions, are succeeded by stupor and paralysis. Inflammation of the spinal cord presents similar symptoms; excepting of course any modifications of purely cerebral functions. With nephritis, the secretion of urine is first increased, then diminished; and so with regard to other secreting organs. In pneumonia, dyspnœa represents increased respiratory effort, but this is attended with imperfect aëration of the blood and the retention of hydro-carbonaceous matter. Accumulation of excrementitious matters in the blood is the most serious consequence of inflammation affecting any specially excreting organ; as the kidneys or skin.

By itself, pain has, we have seen, but little diagnostic importance; yet from this point we can trace the origin of inflammatory fever.

*Constitutional Symptoms—Inflammatory Fever.*—The phenomena of this fever are briefly these:—the heart's action is excited, the pulse becoming more forcible and frequent than usual, and in some cases, less compressible; the skin is dry and hot, the urine scanty and high-coloured, the tongue furred, the bowels probably constipated, and the fæces dry and hard; thirst and inappetency, weakness with general nervous excitement, —restlessness, sleeplessness, and hurried respiration, are also primary phenomena. Hence, the vascular, secretory, and nervous systems, are together engaged in a constitutional disorder—symptomatic of the local inflammation.

*Febrile urine* exhibits physical characters and chemical peculiarities of peculiar importance. At first, it has a deep red colour, strong urinous odour, super-acid reaction, high specific gravity; and the quantity secreted in a given time is diminished. These alterations are chiefly owing to a reduced proportion of water, rather than of solid constituents in the urine, which has thus become concentrated. But the inorganic salts, especially the chloride of sodium, are diminished, both absolutely and relatively; while, uric acid and the urates are increased. Even when urates are not deposited, there is always an excess of uric acid. Urea is increased in some cases, and probably diminished in others. The greatest quantity present would appear to be in meningitis, and an excess is found during exudation; but urea is diminished during resorption, in pneumonia, pleurisy, and in acute rheumatism, especially if accompanied with endocarditis. Extractive matter is generally increased, and lactic acid is often present. Occasionally, a small quantity of albumen is found, but only for a short time. As inflammatory fever declines, the urine deposits a lateritious or brick-dust coloured sediment, more or less abundant, consisting of urate of ammonia.

The quantity of sweat is much diminished during inflammatory fever, but its chemical composition at that time is not well understood. Ulcers,



also, which have been discharging freely become dry. The flow of saliva is less free, and the tongue furred. This appearance arises from a material of whitish yellow or brown colour and firm consistence, overlaying the posterior and middle portion of the tongue on its upper aspect, and adhering closely. It cannot be removed altogether by scraping, but as the fever declines it is shed spontaneously. If, says Dr. Thomson, this furr arose from the nature of the saliva secreted, then, instead of being found only on the upper, middle, and posterior parts of the tongue, we should find it incrusting the whole internal surface of the mouth. It is probably secreted from the papillæ to which it adheres. A similar appearance arises from irritation of the stomach, without any fever at all. Discrimination, therefore, is necessary, by considering whether other symptoms concur.

*Blood.*—The Blood undergoes certain very important alterations in inflammation, and which are of two kinds; namely, in respect to its vital properties, and therefore as affecting its coagulability and coagulation; and in respect to its chemical composition.

The altered vital properties of the blood comprise: an increased tendency to coagulation, and to the separation and contraction of the fibrin in a free state. The phenomena known as the buffy coat and sizzly blood are thus produced. These appearances can be understood by comparing the changes which take place, as observed in the coagulation of healthy blood.

Let a pint of fresh-drawn blood be exposed in a shallow basin; immediately a vapour, having a faint odour, arises, which (*halitus*) was first noticed by Haller. In about four minutes a pellicle appears at the edge of the vessel, soon extending over the surface of the blood and down the sides of the vessel. It pervades the whole in about eight or nine minutes. The fluid blood is thus converted into a jelly. But in a variable period, from seventeen to twenty minutes, or much later, this jelly begins to shrink away from the sides of the basin, and the colourless, transparent serum exudes—a process which, continuing for several hours, or even days, at length leaves a blood-red clot, floating about in limpid serum. And what is this clot? The *fibrin* of the liquor sanguinis, which has spontaneously solidified into fine homogeneous filaments, interwoven like felt, and which has caught and involved the red corpuscles. They also have spontaneously aggregated, their disc-shaped surfaces cohering side by side, and forming *rouleaux*, like piles of money, which then connected themselves into an irregular network; the shrinking of this fabric, intertwined with that of the fibrin, expressed the serum, and thus aided the solidification of the clot. Two constituents, therefore,—the fibrin and red discs,—together spontaneously aggregate to form the clot, which consists of woven filaments, involving the net of red-discs. The expressed serum is structureless. The pale or colourless corpuscles are irregularly distributed throughout the clot and serum.

These changes are represented in the following table.

Fluid Blood.	{ Liquor Sanguinis. Corpuscles.	{ Serum. Fibrin.	} Clot.	{ Coagulated Blood.

The experimental observations of Dr. B. W. Richardson\* apparently demonstrated that this process of coagulation is essentially associated with

\* The Cause of the Coagulation of the Blood, 1858.

the elimination of ammonia—a most significant fact. More recently however, the observations of Professor Lister\* tended to negative this conclusion; and it is, I believe, regarded as no longer tenable.

If the blood, freshly drawn as we have supposed, be inflammatory, its coagulation then presents a clot, the upper portion of which is pure fibrin, of a tawny-yellow colour, and known as the *buffy coat*. This, therefore, consists of a portion of fibrin, which has coagulated apart from the mesh formed of red discs. And what is the immediate cause of this kind of clot? Obviously, that the red discs separated and subsided from the liquor sanguinis before the fibrin began to coagulate. How does such isolation arise? Possibly in either of two ways, or by a concurrence of both. The fibrin may coagulate so slowly as to allow time for the blood-discs to separate and subside. But Dr. Stokes† watched the coagulation of inflammatory blood in twenty-seven cases. In fifteen of them the buffy coat formed; in the remaining twelve it did not. In four of these twelve samples of ordinary coagulation, it began only at the end of eight minutes after venesection, and in other three of this series not until after twenty to forty minutes had elapsed—making a range between the two extremes of from eight to forty minutes. This delay of coagulation gave ample opportunity for the red discs to escape from the fibrin during its solidification; yet they did not subside, and the usual red clot formed. On the other hand, in twelve of the fifteen samples of buff-forming coagulation, the yellow clot of pure fibrin formed in only five minutes, and in the remaining three it was delayed only to ten minutes; so that, during this comparatively short period of five or ten minutes, the red particles had separated and settled down, leaving the buff-coloured fibrin free and floating. Slow coagulation, therefore, does not explain the production of the buffy coat.

The only other active element in coagulating blood is the mesh-forming discs; and how do they behave in freshly-drawn inflammatory blood? They individually possess undue power of aggregating (H. Nasse), and the net thus wrought has also undue power of contracting (W. Jones), whereby the serum is more effectually expressed from its meshes. This fabric, therefore—the component particles of which have individually greater specific gravity than the serum—has now even greater weight, bulk for bulk, and being formed earlier than usual, subsides in the serum before the fibrin has fairly solidified, or perhaps before this more essential element of the clot has begun to coagulate. John Hunter seems to have anticipated this view of buffy blood, and Schroeder Van der Kolk, with other observers, have corroborated it.

Combining all these observations—formation of the buffy coat seems to imply an increased separation and contraction of fibrin in a free state, rather than its increased power of separation and contraction, and that the blood-discs are the initiative and active element in the process of buff-forming coagulation.

Slow coagulation of the fibrin will, however, favour this result, by allowing more time for the gregarious blood-discs to flock together and exercise their function as a contracting mesh. If, therefore, the blood be artificially preserved in a fluid state, by adding serum to above its proportion, thereby delaying coagulation; the red-discs aggregate and subside, and the buffy coat is presented.

\* Lecture before the Royal Soc. Lond., *Lancet*, 1863, Vol. ii., Nos. vi. vii.

† *Brit. and For. Med.-Chir.-Rev.*

Probably all the causes I have mentioned concur to produce this result, and that as they prevail more or less during the act of coagulation so is the buffy coat of pure fibrin more or less completely established.

The earliest intimation that blood is about to undergo this kind of coagulation, is the appearance of a violet tint, not unlike the bloom of black Hamburg grapes, on the surface of the exposed blood. This appearance was, I conceive, noticed by Hunter, and regarded by him as due to the red particles shining through a thin layer of buff-coloured lymph, just as blood in the veins gives a similar tint when viewed through the skin. The tint will therefore vary as the layer of fibrin becomes thicker. Coagulation proceeding, if the mesh of red particles separate and subside from the fibrin, but yet slowly and incompletely, and if the free fibrin but imperfectly solidifies and contracts, then a loose *sizy* clot is produced, resembling a solution of isinglass, attached to the sides of the vessel, and scarcely trembling when shaken. If, again, the separation and contraction of pure fibrin be more complete, a flat, yellow buff-coloured cake is produced, swimming in serum; but the under portion of this clot is red as usual by admixture of the red discs. If, again, the separation and contraction of fibrin be still more complete, the fully-formed, solid, and buff-coloured clot is presented, withdrawn from the sides of the vessel, and probably concave or *cupped* on its upper surface: the lower portion of this clot having formed more slowly, has therefore contracted more strongly, and drawn down the central part of its upper aspect. The blood, or rather clot, is buffed *and* cupped. Even in such case the red particles and fibrin do not completely separate. In thirty samples of buffed blood, carefully inspected by Dr. Richardson,\* he never failed to find red discs in the lower portion of the clot, and in many instances this red lower portion had the consistence of ordinary coagulum.

The *diagnostic value* of these appearances is not absolute. Invariably present with inflammation, they are also present in other conditions affecting the blood. Coagulation exhibits the buffy-coat notably in pregnancy, and other conditions attended with an excess of fibrin in the blood; and both the buffed and cupped appearance may proceed from slow coagulation, without any change in the constitution of the blood itself, as when this fluid is drawn quickly, in a full stream, and received into a narrow deep vessel. Conversely, exposure, as by a trickling stream, into a shallow vessel, hastens coagulation, and thus prevents these results.

Besides these deviations in the process and product of healthy coagulation, inflammatory blood is found to have undergone certain alterations in respect of chemical composition. Its constituents, no less than their properties and endowments, are perverted. Becquerel and Rodier enumerate the following alterations in the blood of acute phlegmasiæ:—

1. An increased proportion of fibrin.
2. A decrease of globules.
3. A decrease of albumen of the serum.
4. An increase of fatty matters.
5. A decrease of soda and soluble alkaline salts.

In point of practical interest, the importance of all these chemical changes appears to concentrate in the influence they exercise on the separation of the fibrin, and its coagulability in a free state.

Alkaline salts in excess are well known to retard coagulation, and a

\* Op. cit., p. 335.



decrease of the soda and soluble alkaline salts will have the opposite effect. Less time than usual is then allowed for the blood-discs to subside, and so far the formation of the buffy coat is not promoted.

An increased proportion of fatty matter will probably favour the early separation of pure fibrin, by inducing it to rise with such matter to the surface (of the blood drawn), and leave the red discs below.

A decrease of the albumen of the serum will have a similar effect, by directly diminishing the specific gravity of this fluid, so that the blood-discs sink more readily. The mean specific gravity of the serum in the phlegmasiæ generally, is estimated by Becquerel and Rodier at 1027·0; and although, according to Nasse, that is about the average in health, yet the specific gravity of serum in inflammations frequently declines below the mean of 1027. And this is due to the proportion of albumen being reduced below the healthy average of 80 parts in 1000, to 73·35, and even as low as to 64·84. It was formerly stated by Gendrin\* that the albumen rose to about twice its proportion above the standard of health. The decrease noted is in a direct ratio to the increased proportion of fibrin.

So also the blood-discs decrease in quantity proportionately to the increase of fibrin (Simon), and this reduction will facilitate their complete separation—the more so, since, by undue aggregation of the discs, their combined specific gravity preponderates even more than they do individually.

Lastly, the increased proportion of fibrin above the average of two to two and a half parts in 1000 of blood, contrasting as it does with the reduced proportion of blood-discs, is the culminating point in favour of a clot being formed of pure fibrin; and this increase, and corresponding formation of the buffy coat, was noticed by Andral and Gavarret to rise as high as ten parts in 1000 of blood drawn, in acute articular rheumatism, and in pneumonia.

The source of this additional proportion of fibrin is doubtful.

Simon suggests that the blood-discs are transformed into fibrin, and in conformity with an acknowledged physical law, that as textures waste in proportion to their functional activity, so therefore the blood-discs disintegrate more abundantly in inflammation—owing to their function as bearers of oxygen, to the various textures being overtaxed, in the more frequent transmission of these discs through the lungs, by acceleration of the blood's circulation. The flotilla of oxygen-laden cells perishes *seriatim* from overpressed service, and their wrecks are converted into fibrin. Simon's statement that the discs decrease in quantity proportionately to the increase of fibrin, harmonizes with his theory; but, against it, Becquerel and Rodier urge that this destructive change ought to take place whenever the circulation is accelerated, and therefore whenever fever exists. Yet an increased proportion of fibrin is not found in other fevers accompanied with an accelerated circulation.

Is the excessive fibrin transformed albumen? Probably similarity of composition allows of such transformation; and certainly, as the albumen diminishes in quantity, so does the proportion of fibrin increase.

Of this metamorphosis we know neither the cause nor the mechanism. (Becquerel and Rodier.)

Summarily, the coagulation of inflammatory blood—when drawn and fresh—amounts generally to this: the blood-discs, having an undue tendency to aggregate, and the net they form an undue power of contracting,

\* Hist. Anat. des Inflammations, 1826, t. ii.

more speedily sink in serum, normally of less specific gravity than the discs individually, of still less than the shrunken nets of discs; and that this separation of the discs (before coagulation of the fibrin) is facilitated by their reduced number, and by diminished specific gravity of the serum itself. The fibrin then coagulates free of blood-discs, at least in its upper portion, and rises to the surface of the serum, its ascent being probably aided by admixture with the free and floating fat.

Such is the coagulation of a sample of inflammatory blood, such the process that sample after sample of inflammatory blood undergoes.

It might therefore be inferred that the whole mass of blood, when subject to the influence of inflammation, is ready to undergo these changes, and that it would present the same alterations of chemical composition if withdrawn from the living body. But does the exalted tendency of the blood-discs to separate, and consequently of the fibrin to coagulate in a free state, prevail in the living body, and affect the whole mass of blood?

This question is highly important; for the nutrition of every part of the body, beyond that which is inflamed, must be modified by excess of fibrin in the blood—hyperinosis, and by its undue separation and coagulation. A blood-crisis bordering on the inflammatory encourages nutrition; a further degree of the same condition of blood encumbers this process with superfluous material. The former is a salutary provision to meet the exigencies of nutrition,—in growth and repair; the latter, an oppressive compulsion to overgrowth, or at least to an overflow of the redundant nutritive material. Behold, then, a reparative power; behold an impending evil.

The question proposed is at present open to much, very much, further inquiry.

*Pathology of Inflammatory Fever.*—The alterations of the blood, in connexion with inflammation, proceed apparently from the persistent local determination of blood, coupled with the increased productiveness and destruction of the textures. The increased proportion of fibrin; and the increased tendency to coagulation, and to separation and contraction of the fibrin in a free state, forming the buffy coat; are both commonly proportionate to the extent of the inflammation, and its duration in an active state. Under similar circumstances of nutrition, the same blood-conditions are induced in a greater or less degree; as during pregnancy, when the uterus is growing; and the buffed appearance of the blood is readily induced by inflammation in fast-growing children, in whom also the plastic products are then unusually copious.

Inflammatory Fever was formerly supposed to arise from the increased proportion of fibrin in the blood, or hyperinosis, as the cause of febrile excitement of the circulation, and the other functions involved. Hunter advocated this interpretation of inflammatory fever, and he gave cases, which as tested by venesection, seemed to support it.

But, the recent results of chemical analysis indicate that inflammatory fever may possibly be absent with hyperinosis, or present without it; and they certainly prove beyond doubt that the degree of inflammatory fever cannot be measured by the amount of hyperinosis. MM. Becquerel and Rodier estimate the increase of fibrin in various diseases to range from the healthy average of three to ten parts in one thousand of blood; and that a slight increase from three to five takes place in chlorosis; in certain cases of scurvy, more especially when it assumes the chronic form during



pregnancy, and in erysipelas of the face; yet surely the two first mentioned diseases are not inflammatory, nor are the ordinary constitutional symptoms of pregnancy those of inflammatory fever. On the other hand, a diminished proportion of fibrin below the average of three in one thousand was noted in scarlet fever, small-pox, and measles; but the ordinary type of these fevers is inflammatory in a high degree. Lastly, when present, the degree of this fever does not correspond with the amount of hyperinosis. A great increase of fibrin up to ten in one thousand was noticed in acute articular rheumatism, in pleurisy, and pneumonia; and a proportion varying from five to ten was also found in peritonitis, bronchitis, and severe erysipelas of the face—diseases which are accompanied with at least as high a degree of inflammatory fever as pleurisy or pneumonia.

The foregoing facts and considerations compel us to attribute the accompanying inflammatory fever to some other source than the blood; and the only other bond of sympathetic connexion between the heart and inflamed part is the nervous system.

Many years since, Abernethy suggested this channel of communication,\* and subsequently, Travers pointed out the agency of the nervous system, and drew the distinction between nervous excitement alone and inflammatory fever. Although he attributes this fever to excitement of the circulation from hyperinosis, yet he observed that the first morbid impression was upon the nervous system, and transmitted by the nerves of the part injured or inflamed to the nervous centre, and thence to the organs of circulation. In proof thereof, Travers urges the priority of nervous excitement in the development of inflammatory fever. “The *premonitory* symptoms—viz. headache, lassitude, disquietude, nausea, chilliness, and rigor are indications of the more or less troubled condition of the nervous centres; to these the alterations in the measure and force of the circulation, the permanent and sensible changes upon the internal and external surfaces, and their secretions, *succeed*—viz., quick pulse, hot skin, dryness of the mouth and fauces, furred tongue, vitiated and scanty secretions,”† &c. I have italicised two of these words in order to bring out the force of this paragraph.

Nervous excitement may stop short of inflammatory fever, or may be followed by, and remain associated with, excitement of the sanguiferous system, and either element may then predominate. Thus, “irritation may be a symptom of fever, as fever may be an effect of irritation; but they are originally and essentially distinct forms of disease, and either may exist in the absence of the other.”‡

Certain of the nervous phenomena which precede and accompany inflammatory fever are difficult of explanation. I allude more particularly to inappetency and thirst. Healthy hunger and thirst are now generally allowed by physiologists to be sensations expressing corresponding requirements of the system, rather than proceeding from conditions of the stomach. “These sensations,” observes Dr. Carpenter,§ “bear no constant relation to the amount of solid or liquid aliment in the stomach, whilst they do correspond with the excess of demand in the system over the supply afforded by the blood; and they abate by the introduc-

\* Constitutional Origin, &c., of Local Diseases, 1824, p. 3.

† Physiology of Inflammation, 1844, pp. 62-63.

‡ Constitutional Irritation, 1826, p. 493.

§ Principles of Human Physiology.

tion of the requisite material into the circulating blood, even though this be not accomplished in the usual manner by the ingestion of food or drink into the stomach." Agreeably to this physiological provision, inflammatory fever should be attended with hunger, rather than inappetency. Albumen is the pabulum most extensively demanded by the tissues for their support, and its proportion in the blood declines considerably during inflammation; yet this deficiency is accompanied with the loss of appetite. Again, the secretions are suppressed, and water, therefore, retained in the blood; yet this excess is attended with incessant thirst. Further investigation is needed to clear up these anomalies. All the other phenomena which I have enumerated as emanating from the local irritation spreading through the nervous system, are symptoms of excitement mingled with exhaustion. The *sympathetic* fever—not inaply so called—thence arising, is said to have similar types; the *sthenic*, denoted by forcible action of the heart, and a strong, hard pulse; the *asthenic*, pronounced by feeble, and rapid action of the heart, and a quick, weak, perhaps irregular pulse. But, after all the distinctions that have been drawn between these types, they are seldom well defined in Nature. Daily circumstances will modify the character of inflammatory fever during its course in the same individual.

Does the temperature of the body rise during this fever? Dr. Thomson states that it ranges from the low extreme of 94° up to 107° Fahrenheit. This is partly due at least to suppression of the perspiration, and, therefore, the retention of that heat which would otherwise pass off by evaporation from the skin. But the excited nervous system probably contributes to the production of heat. Sir B. Brodie's experiments\* show that if the encephalon be removed, the body speedily loses its temperature; a doctrine subsequently confirmed by the experiments of MM. Le Gallois and Chossat. Certain pathological observations also lead us to infer that the loss of nervous influence in any part is accompanied by a loss of temperature there.† On the other hand, the production of increased heat is attributed by Simon to chemical changes in the textures of the inflamed part, and in the blood, and thence in all blood-supplied textures. This chemically changeful state of the blood and textures, with the evolution of heat, are, by the same author, said to constitute inflammatory fever; and that its symptoms are those of this greater heat and change.

Thus far respecting the pathology of inflammatory fever, and its origin from the local irritation of inflammatory swelling.

But does this fever arise exclusively from inflammation? It has been alleged that febrile symptoms may precede the local, as in all internal inflammations arising from external cold.

To determine this question, take, for example, pneumonia. In most cases, inflammation of the pulmonary texture is consequent on the impulsion of blood by exposure to cold. The superficial blood-vessels contract under the influence of cold, the blood retires from them, and the vessels of internal organs become surcharged or congested. The lungs, in their connexion with the whole pulmonary circulation, are especially liable to be the seat of congestion. The heart, overtaxed, fails, for a time at least, to propel the blood through the distal pulmonary vessels, as it also fails to force the blood through the more distal systemic veins

\* Physiological Researches, 1851, repub. from Phil. Trans.

† See Med.-Chir. Trans., vol. vii., H. Earle; also, Human Physiology, Dunglison, 7th edit., vol. ii. p. 238.

leading to the surface of the body; the pulmonary veins become engorged with blood, stagnant, or nearly so. By-and-bye, the heart arouses, as it were, from its lethargy, and makes an effort to restore the systemic circulation, and to clear the pulmonary veins of their superfluous blood. This is reaction, attended with a glow of returning warmth and colour; and, simultaneously, determination of blood through the lungs. Reaction does not precede the determination of blood, and if it advance only so far as to restore the average force and frequency of pulse peculiar to the individual, such healthy reaction cannot be called fever; and if it proceed beyond this standard, and the determination of blood become persistent—in fact, inflammatory—even then inflammatory fever arises simultaneously with inflammation, and does not precede it. Then, as in other inflammations, the development of the fever follows the local determination of blood.

CAUSES; *External and Internal,—Exciting and Predisposing.*

The *External* causes of inflammation are manifold, but they may all be included under four heads. (1) Mechanical injury or irritation; as wounds, fractures, dislocations; or foreign bodies, introduced into the organism, as grit, portions of clothing, a splinter of wood, a bullet, and parasites, animal and vegetable; (2) Heat and Cold; (3) Chemical agents which decompose or kill living animal matter, as strong acids, caustic alkalies, chloride of zinc, and other escharotics; (4) Vital irritants, or animal and vegetable poisonous matters, and some mineral poisons; as the venom of noxious animals and plants, cantharides, mustard, capsicum, essential oils, arsenic, etc.

*Internal* causes may be either exciting and immediate, or predisposing, in their operation.

*Exciting* internal causes comprise, the blood, textures, and excretions, of the body, severally, under peculiar circumstances; and morbid products, organized and unorganized.

Blood extravasated and decomposing is a foreign body. So also are the various textures, when dying or dead; in the form of slough of the soft tissues, sequestrum of bone. The various excretions; as urine, fæces, bile, are irritants to the organs which naturally contain them, if such matters be in a state of decomposition; or if, being themselves healthy, they are extravasated; as urine into the scrotum, feculent matter into the peritoneum. These excretions are peculiarly obnoxious to cellular texture and serous membrane. Lastly, morbid products are apt to excite inflammation. Of deposits, softened tubercle does so in the lungs and other parts; of growths, cancer especially has this effect, the ichorous discharge more particularly being irritating. Calculi are familiar examples of unorganized products exciting inflammation in organs where they occur. For example, a stone in the kidneys provokes nephritis, in the bladder, cystitis.

*Predisposing* internal causes are those conditions which may constitute inflammation, only in a lesser degree; or short of, though bordering on inflammation. But the predisposition differs according to the nature of the cause which excites inflammation. Thus, an excited state of the vascular system favours the production of inflammation from local irritation; whereas, a depressed state of the vascular system favours the development of inflammation from exposure to cold.

It is not easy to refer an inflammatory predisposition to any one element of inflammation; but an approach to certain illustrations of their



respective influences is exhibited by the inflammation of different parts, wherein one or other of these elements predominate.

Thus, tissues whose reproductive power is greatest, and which are commonly, also, most vascular, are prone to inflammation; as for example, the skin compared with fibrous or tendinous structures. So also, tissues whose productive power is temporarily exalted, are ready for inflammation; as during the growth of the body in childhood and youth. The more vascular organs are similarly inclined; the lungs, for example, as compared with most other organs. The condition of the blood is specially influential; rheumatic and gouty inflammations are ever impending when an excess of lactic, or of lithic acid respectively is in circulation. Thence the predisposing influence of constitutional conditions generally, most of which are blood diseases manifested by various local inflammations, and ever ready to recur—as secondary syphilitic diseases of the skin and other parts, scrofulous affections of the bones, skin, and other textures. Other blood conditions predispose, as unquestionably, to local inflammations; but they require for their development the co-operation of external exciting causes, in each case peculiar, relatively to the special condition of blood, which is thereby brought into action. All the infectious and eruptive fevers are of this kind. [P. p. 310 et seq.]

Predisposition through the influence of the nervous system is evoked by nerve injuries, the operation of which in producing peripheral inflammation is thus generalized by Simon: "A part deprived of sensibility becomes specially incapable of protecting itself against mechanical and chemical irritants, and accordingly inflames—*e.g.*, the urinary bladder, subject to the action of retained urine, in paralysis. A part injured in respect of its innervation, is likely to suffer some circulatory disorder, with corresponding disturbance of natural temperature, and proneness to inflammation."

The co-operation of all these elements will render the predisposition complete, and almost give rise to inflammation. Thus, the functional activity of any organ, implying the concurrence of all the conditions essential to nutrition, in excess; such activity is accompanied with a proportionate proclivity to inflammation—as in the mammary glands, after parturition when lactation commences, and during its continuance, or the ovaries at the period of menstruation.

The operation of inflammation itself, as an internal cause, is both local and constitutional.

*Locally*, inflammation operates by extension, continuously, in the texture or organ affected; contiguously, to parts adjoining; or, by transference (metastasis) to a part remote from that originally affected, the inflammation then subsiding.

*Continuous* extension is witnessed in the progress of inflammation along the skin or mucous membrane—as in erysipelas, and the sore throat of scarlet fever.

*Contiguous* extension is illustrated by ulceration of the articular cartilages of any joint, consequent on caries of the adjoining head of bone, or on synovitis. Thus also osteitis supervenes on periostitis; cellulitis on inflammation of the skin, and conversely. Taking internal organs, from the head downwards: meningitis is succeeded by cerebritis; scrofulous and purulent ophthalmia, by inflammation of the cornea and deeper textures of the eye; laryngitis, by inflammation of the subcellular texture and œdema glottidis; gastritis, enteritis, cystitis, and metritis, respectively, may extend to the peritoneum, giving rise to peritonitis.



The *transference* of inflammation is exemplified by orchitis supervening on the sudden suppression of gonorrhœa.

Such then is the general operation of Inflammation locally ; constitutionally, its operation as an internal cause, was traced in the origin and development or the pathology of inflammatory fever.

**COURSE and TERMINATIONS.**—Inflammation may proceed to either of four Terminations ; Resolution, or disappearance ; Effusion, or lymph-production ; Suppuration, or as pus-formation ; Ulceration and Gangrene, or death of texture. Excepting the first of these terminations, that of resolution or simply cessation of inflammation, the line of demarcation between each of the remaining three modes of termination, is indistinct, and they are commonly more or less combined. A more definite line of distinction may be drawn between them, by regarding the course of inflammation in reference to its two principal constituent elements ; increased productiveness, and increased destruction, of texture. According as one or other of these predominates, so may we associate therewith the remaining terminations of inflammation respectively ; as effusion, and suppuration ; ulceration and gangrene.

1. *Resolution.*—Inflammation may subside and terminate without any permanent structural result. The redness fades away, the part recovers its healthy temperature, slight swelling if perceptible subsides, and exalted sensibility or pain ceases ; while any inflammatory fever passes off. This is resolution ; a termination of inflammation by the concurrent cessation of all the elements of this process ; and consequently, the cessation of its local and constitutional manifestations.

2. *Productiveness* may predominate ; then, Inflammation proceeds to Effusion, or, perhaps, Suppuration ; an increase of new material in the part, beyond the small proportion which necessarily attends inflammation. Liquor sanguinis appears, consisting of coagulable lymph and serum. In the latter constituent, the proportion of albumen and of salts is increased ; but of these there is a larger proportion of chloride of sodium and phosphates than in the blood.

Three conditions of lymph may be distinguished by tolerably well marked structural characters : the fibrinous and corpuscular of Paget, and a transition condition, consisting of both fibrils (filaments) and cells, the latter predominating. Similar susceptibilities of organization represent the varieties noticed by Dr. C. J. B. Williams, as the euplastic, aplastic, and cacoplastic. They differ also in point of vascularity, in the course of their development.

With these typical conditions of structure are associated tolerably definite physical properties : Fibrinous or Euplastic lymph—transparent, nearly colourless, and tenacious. Corpuscular or Aplastic lymph—opaque, yellow, diffuent. Transition condition or Cacoplastic lymph—opakish, yellowish, and less tenacious than the euplastic type. These characters are more clearly contrasted when placed in juxtaposition.

#### LYMPH.

	Fibrinous.	Transition condition.	Corpuscular.
<i>Physical properties</i>	Transparent.	Opakish.	Opaque.
	Colourless.	Yellowish.	Yellow.
	Tenacious.	Tenacity less.	Diffuent.
<i>Structure</i>	<i>Fibrils.</i>	Cells.	Cells.
	Cells.	Fibrils.	Granules.
	Bloodvessels.	Bloodvessels few.	Bloodvessels absent.
	Ex. False membranes.	Ex. Cirrhosis.	Ex. Pus.

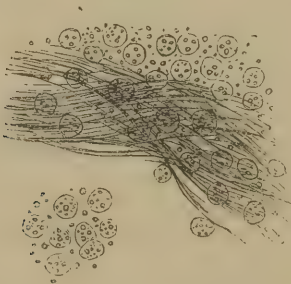
The qualities of lymph are certainly most obvious when it is effused from simple membranes, as the serous—for instance, pleuritic effusions; while the more complex structure of skin and mucous membranes retard its separation, and modify its properties by the admixture of their own secretions. Hence the varied products of skin diseases, and those discharged from the gastro-intestinal canal, the urinary and pulmonary passages. Nevertheless, the peculiarities I have mentioned are fully confirmed by the observations of Mr. Paget, who carefully examined the materials exuded in thirty cases of blister from cantharides.

It will be desirable first to describe, more particularly, the elementary products of Effusion, including Suppuration; and then, their apparent source and mode of production, or the pathology of Effusion.

*Effusion—Products of Inflammation.*—(1) Coagulable lymph is more or less tenacious and at first transparent, but it acquires a slightly opaque yellow colour. It is produced in the form of minute villi. This appearance is best seen on free surfaces which are least subject to motion or pressure; as between convolutions of the intestines in peritonitis; between the lobes of the lungs in pleurisy; and about the base of the heart in pericarditis. But wherever serous surfaces are in contact and play upon each other, the ductile lymph is drawn into threads or plastered into films; as on free portions of the pericardium and pleura, and on the parietal aspect of the intestines.

Coagulation having taken place, coagulated lymph is somewhat solid, though still retaining its tenacity and opakish yellow colour. Its organization, in this its simplest condition of structure, is that of fine filaments, interwoven in various directions; as in the buffy coat of blood.

FIG. 1. \*



These filaments are formed apparently by the linear union of molecules, are homogeneous, and from  $\frac{1}{14000}$  to  $\frac{1}{10000}$  of an inch in diameter.

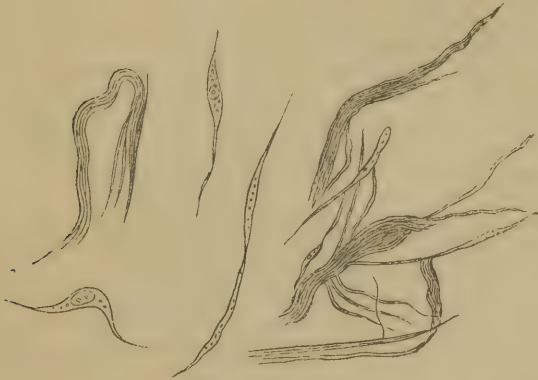
(2) *Cells* or corpuscles form in coagulable lymph, and are found interspersed among the molecular formed filaments, in coagulated lymph. These cells contain each from three to eight granules, the diameter of which equals that of the filaments. The cells themselves range in size from  $\frac{1}{1300}$  to  $\frac{1}{1000}$  of an inch. (See Fig. 1.) They have been named plastic by Dr. Bennett, because occurring so often in plastic lymph; and also named

\* Molecular fibres and plastic corpuscles, in simple exudation on a serous surface. Above are corpuscles after the action of acetic acid. 250 diam. (Bennett.)

pyoid by Lebert, from their general resemblance to pus corpuscles. But neither water nor acetic acid much affect these plastic cells.

Cells of this kind undergo development. By elongation, they assume an oat-shape; prolonged yet further in opposite directions, they are attenuated into filaments,—forming fibre-cells. Thence is produced *fibro-cellular*, or *connective*, tissue,—generally, the highest state of organization of inflammatory effusion. (Fig. 2.)

FIG. 2.



Blood-vessels are found in organized inflammatory lymph, and possibly in coagulated lymph, but they do not appear to be formed in it; they project into the new tissue from the structure on, or in, which it is placed. The vessels are formed by the same process of sprouting, coalescence, and construction of loops, as in granulations. Lymphatics were discovered by Schroeder Van der Kolk\* in false membranes. Nerves have been twice seen by Virchow† in adhesions; one of the pleura, the other of the peritoneum—between the liver and diaphragm.

*False Membranes* are formed on the inner or free surface of serous, and of mucous membranes; as in pleurisy, pericarditis, and peritonitis; in croup, and dysentery. Such membranes consist of inflammatory-lymph, which has undergone more or less development; and on serous surfaces, it may reach the state of organization just described, that of fibro-cellular tissue, supplied perhaps abundantly with blood-vessels.

The physical characters of false membranes vary according to their more or less high degree of organization and vascularity; the membrane formed is either pliant and yielding, or tough and unyielding.

Adhesion is apt to take place when the opposed surfaces of a serous cavity lined with inflammatory lymph, meet together. Similar adhesion may take place in wounds, or under other circumstances. Any such result of inflammatory lymph-effusion is sometimes referred to *adhesive inflammation*.

Other and more highly-developed tissues are reproduced. Many such results of inflammatory lymph-production are adduced by Paget.

\* Spec. Anat. Path. de Vasis novis Pseudo-membranarum, 1842.

† Würzburg. Verhandlungen, i. 144.

Adipose tissue may be formed, if not directly from inflammatory lymph, yet in the fibro-cellular tissue of completely organized adhesions. Elastic tissue is sometimes abundantly formed in the adhesions developed from inflammatory lymph, and particularly in those of the pleura. Epithelium covers the surfaces of well-formed adhesions. Fibrous tissue is produced from the development of inflammatory lymph, interstitially deposited in any fibrous tissue; as in ligaments, capsules of joints, &c. Bone is often formed, either as a late transformation of inflammatory lymph, which had become organized into perfect fibrous tissue—*e.g.*, osseous plates in false membranes of the pleura, and in those of the pericardium, which plates are not true bone; or new bone appears in the form of ossific deposits, connected with inflamed bone or periosteum. Cartilage is possibly formed in chronic rheumatic arthritis.\* This new cartilage is prone to ossify.

Lymph-effusion may undergo *absorption*; or if persistent, its operation may be either destructive, or reparative and constructive, and accordingly, unfavourable or favourable to the function of the organ or texture affected.

*Destructive* consequences of lymph-effusion are illustrated by many organs. The heart may be shackled by tags of false membrane, which continually restraining the action of this organ, at length induces its hypertrophy; a compensatory provision of increased structure for extra contractile power. Or the heart may undergo compression by great thickening of the cardiac reflexion of the pericardium, in consequence of the interstitial deposition of lymph therein, and thence the organ becomes atrophied. The lungs may suffer in like manner, either way. Peritonitis is apt to agglutinate the abdominal viscera into one mass. Within the substance of parenchymatous organs, contractile lymph being deposited, they become stuffed, consolidated, and sometimes atrophied and granulated. Such are old hepatized lungs, cirrhotic liver, and granular kidneys. Strictures are liable to form around canals; as the œsophagus, rectum, and urethra, narrowing or closing them and proportionably interfering with the functions of these passages. Eventually displacements of moveable viscera are wrought by the slow contraction of lymph-deposit, overcoming the struggle of function to recover the right adjustment of parts.

Analogous mischief may happen to the mechanism of the limbs; joints become stiffened by firm fibrous ankyloses, the tendons are bound in their sheaths, and the fasciæ agglutinated, in chronic rheumatism.

This fettered condition of organs, their consolidation and atrophy, obstruction, and displacements, are the principal destructive results of lymph-effusion.

On the other hand, its operation is not unfrequently reparative, to reinstate an old function, or constructive, to fulfil a new and useful purpose.

The *reparative* power of adhesive inflammation is manifested by the healing of incised wounds in those cases where the effusion of lymph is induced by inflammatory hyperæmia. The repair of simple fracture and of simple dislocation, when reduced, is an analogous process, and commenced probably by inflammatory hyperæmia consequent on the

\* Trans. Path. Soc. Lond., vol. iii. 1851. By W. Adams.



injury. So, also, wounded arteries are permanently closed by adhesion of an inflammatory character in some cases; and the healing of ligatured arteries is certainly effected by adhesive inflammation, which seals the divided coats of the vessel above and below the line of ligature. Penetrating wounds of the thorax and abdomen, implicating the viscera, afford ample and varied evidence of the reparative power of adhesive inflammation. Wounds of the lung are healed by adhesion of the pulmonary pleura consequent on inflammation. Wounds of the abdominal viscera are healed in like manner wherever the peritoneal investment extends; and the visceral reflexion of the peritoneum is very apt to adhere to the parietal reflexion of this membrane opposite the external wound. These results are explained in describing the healing of wounds of the abdomen and thorax respectively. In certain cases the peritoneum is purposely injured by the surgeon, so as to establish adhesive inflammation. This constitutes the radical cure of hydrocele and that of hernia; the former being accomplished by a stimulating injection; the latter by long-continued pressure with a truss; or the radical cure of hernia may be accomplished on the same principle by the successful operation recently introduced by Mr. Wood. Lastly, among the most familiar examples of beneficial adhesive inflammation, I may mention the well-known fact that foreign bodies, long imbedded in the living tissues, thus become enclosed in organized lymph, and their presence rendered comparatively harmless. An encysted foreign body is quiescent.

Reviewing these and similar results, there appears to be sufficient reason to justify Hunter's view of the use or purpose intended by adhesive inflammation. "It may be looked upon as the effect of wise counsels, the constitution being so formed as to take spontaneously all the precautions necessary for its defence; for in most cases we evidently see that adhesive inflammation answers wise purposes."

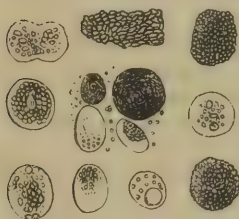
In conformity with this design, we observe inflammatory adhesion preventing suppuration, or confining its extent—in the pleura, in the peritoneum, occasionally; in the synovial capsules, and determining the boundary of an ordinary abscess; beyond which circumscribed limit, in any case, the pus formed cannot pass. Then, again, the same process prepares the way for the discharge of pus, without infiltration of the textures during its passage or escape into any natural cavity through which it may traverse. Any collection of matter having become circumscribed—as an abscess—by the deposition of inflammatory lymph, is gradually conducted through the surrounding textures at their most yielding point; the pathway having been previously paved securely for this purpose by their adhesion. The pus is still watchfully circumscribed during its passage, until at length the contents of the abscess are discharged. An abscess is thus advantageously opened by Nature. Absorption makes the channel, and in the direction of least resistance; but adhesion makes its banks secure. With this precaution a collection of matter is safely conveyed from a great depth in the body, and by an otherwise dangerous route. Witness the evacuation of pus from the pleura (in empyema), through a large and pendulous mamma. Adhesions of other serous surfaces favour the escape of matter. When a student, I once saw an abscess of the liver which pointed and threatened to burst externally, but which eventually relieved itself by perforating the diaphragm and right lung successively, a continuous expectoration of pus

being provided for by adhesion of the pleura where perforation had taken place. Sometimes, by a similar provision, an abscess of the liver discharges itself externally, or into the stomach, the duodenum, or the colon. An abscess of the kidney will also thus communicate with the colon; and an abscess in the right iliac fossa will be emptied into the colon, cæcum, or bladder.

These are instances of a new mechanism being constructed for some new, but perchance temporarily useful purpose, which is perhaps less frequently the intention of reparative inflammation than that of permanently restoring some lost part, and of thereby reinstating a former function.

(3) *Exudation corpuscles* are round or irregular little masses, having a dark and mulberry looking appearance, under the microscope. Their size is about  $\frac{1}{1000}$  to  $\frac{1}{750}$  of an inch in diameter. They consist of granules aggregated together, and sometimes enclosed in a cell-membrane; hence they are named also

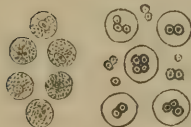
FIG. 3.\*



compound granular corpuscles. (Fig. 3.) Within each of these corpuscles is seen a round transparent nucleus, varying in size from  $\frac{1}{3000}$  to  $\frac{1}{3000}$  of an inch in diameter. The granules vary from  $\frac{1}{12000}$  to  $\frac{1}{8000}$  of an inch. They are fatty. Acetic acid does not affect the cells or masses; but they dissolve immediately in ether, and disintegrate under the influence of potash or ammonia.

(4) *Pus* is a fluid having peculiar physical characters; an opake greenish-yellow colour, diffuent or creamy consistence, faint odour, and an average specific gravity of 1030, but varying considerably, from 1020 to 1040. All the characters of healthy pus differ considerably in the many diseased states of this product.

FIG. 4.†



This fluid consists of a serum in which are suspended an innumerable multitude of corpuscles. (Fig. 4.) They are spherical, somewhat granular-looking cells, from  $\frac{1}{200}$  to  $\frac{1}{300}$  of a line in diameter; and consisting of a cell-membrane, enclosing granular or molecular matter, and a nucleus situated, generally, on the (interior of the) cell wall and adherent.

It varies in size from  $\frac{1}{800}$  to  $\frac{1}{400}$  of a line across, and consists of two, three, or four granules aggregated together. These secondary nuclei are round, oval, sometimes elliptical. The whole cell,—its membrane, and contained molecular matter and compound nucleus, are albuminous. Water distends these corpuscles, and acetic acid dissolves the molecular matter, perhaps also the cell-membrane, and by loosening or breaking up the nucleus, displays its compound structure. (See Fig. 4, the five transparent cells.)

Pus has been analyzed by Güterbock, Valentin, Golding Bird, Wood, Von Bibra, and Wright, with unsatisfactory results.‡ I take the following particulars from the most recent work§ of authority on this subject.

\* Granular cells and masses from cerebral softening. (Bennett.)

† Pus-corpuscles, as seen in healthy pus; the fine transparent cells are as seen after the action of acetic acid. (Bennett.)

‡ See Pathological Chemistry. 1853. By Becquerel and Rodier. Translated by S. T. Speer, M.D. 1857. P. 529.

§ Chemistry in its Relations to Physiology and Medicine. G. E. Day, M.D. 1860. P. 221.

Pus-serum is a clear, colourless, or very faintly yellow fluid, having a weak alkaline reaction, and coagulating by heat into a dense white mass. Albumen is its chief constituent, in proportion from 1.2 to 3.7%. Fatty matter is extracted by ether, and it consists of olein, margarin, oleic and margaric acids, and cholesterin. These fatty matters vary from 2 to 6% of the whole fluid, of which proportion, cholesterin alone often reaches to 1%. Mucin, pyin, casein, chondrin, gluten, and leucine, are occasional constituents. The solid constituents of this serum range from 14 to 16%, of which from 5 to 6% are mineral, and the soluble salts are to the insoluble as 8 to 1. Of the former, chloride of sodium is most abundant, being three times more so than in the serum of blood. The soluble phosphates range from 3 to 10%. The insoluble salts are phosphates of lime and magnesia, with a little sulphate of lime and peroxide of iron. Certain incidental matters may be present in pus, as in any other exudation; namely, bile-pigment, the resinous acids of the bile, urea and sugar.

Pus is seldom found pure, but associated with various ingredients, the débris of surrounding textures, and mixed with secretions. Healthy or laudable pus may thus become serous, mucous, sanguineous, strumous, cancerous, &c. Or pus may be specific, as the syphilitic pus, vaccine matter, pus of porrigi, of glanders, &c.

The *formation* of exudation and pus corpuscles is, probably, as follows. Granules aggregate and constitute a compound granular mass. An investing cell-membrane may gather around such a mass, as a nucleus. Both these are forms of the exudation-corpuscles. Partial liquefaction of the peripheral granular matter of a cell-enclosed mass, may give rise to a pus-cell, with its compound granular nucleus. The chemical metamorphosis of cell-contents, or the substitution of albuminoid for fatty granules, is not understood. But the structural relation of pus-cells to exudation corpuscles, would seem to be a degenerative transformation. Several such transformative conditions of exudation corpuscles are represented in Fig. 3. Pus-cells are also structurally related, in some way, to those of mucus and chyle; and the whole series of cells—including exudation corpuscles—would seem to have a family relationship to the pale corpuscles of the blood; as being rudimentary states of these cells by arrests of their development.

The products of Inflammation are usually found associated; but one or other so far predominates, in different textures or organs, as to give its own structural character to the deposit; in cellular texture and parenchymatous organs, as the lungs, the product is chiefly granular matter and exudation corpuscles; in or on mucous membranes, chiefly pus; on serous membranes, chiefly coagulable lymph.

*Pathology of Effusion and of Suppuration.*—Analogy would lead us to expect a general resemblance between the processes of healthy nutrition and inflammatory effusion;—that the composition and vital condition of the blood will predispose to the formation of certain products; and that this process is affected by the degree of inflammatory hyperæmia, and by the force of the general circulation; that it is regulated by the nervous system; and is completed by the secretory or the formative power of the inflamed structure.

How far does all this anticipation accord with known facts?

First, as to the condition of the blood, in its relation to inflammatory effusion. Serum exudes from the engorged vessels, and fibrin therefore,



may also escape in a fluid state. But inflammatory blood superabounds with fibrin, and consequently this state will tend to deposit it more freely. The liquor sanguinis effused, will be, for the most part, fluid fibrin; and such is the typical character of coagulable lymph, which represents the first product of inflammation, before the formation of filaments, or of exudation, or pus-corpuscles. It is that which appears in the first instance on blistered surfaces, as demonstrated by Mr. Paget's observations.

The quantity of liquor sanguinis, and therefore of fibrin, effused, is further regulated by the degree of hyperæmia, aided by the force of the general circulation.

Virchow denies this explanation of fibrin-production. He argues\* that nobody has ever been able to prove the affirmative experimentally; that "nobody has ever been able, by producing a mere change in the force of the current of the blood, to induce the fibrin to transude directly, as it is wont to do in certain inflammatory processes; for this, some irritation is always required." I shall presently recur to the latter clause in this paragraph; but the want of experimental proof that fibrin is produced in an inflamed part, by the force of the blood's current, is, I think, compensated by familiar observations quite as conclusive as any experiments. When the pulse is strong and hard, the blood flows forcibly through unyielding vessels, and tells on an inflamed part; then fibrin is produced abundantly in that part: when again the pulse is rapid rather than strong, and compressible, the blood is misdirected; then less fibrin is found in the part inflamed. The former condition is illustrated by common phlegmonous inflammation, with much fibrin; the latter, by erysipelas, with much serum. This large proportion of fibrin, or of serum, does not, it is true, necessarily accompany only those states of the local and general circulation to which I have referred. The same results may possibly proceed from, and denote an excess of fibrin, or of serum, in the blood; the presence of the blood's circulation in an inflamed part may not be the only cause of a serous or fibrinous effusion: but whenever the circulation is active and tense, then there is a tendency to the effusion of fibrin; whenever the circulation is feeble and lax, then a tendency to the effusion of serum. The inference obviously suggested by this invariable sequence is, that a mere change in the force of the blood's current is a cause of fibrinous effusion. It is recognised as such in practice. Phlegmon and erysipelas are regarded as representing almost opposite conditions of the circulation.

Beyond these sources of lymph-effusion, it is possible that the character of the deposit may be influenced by the nervous system; but the share of its influence, if any, must be determined by future inquiry.

Lastly, the structure in which inflammation takes place, may itself exercise some power, either by selecting the fibrin from the blood, thereby inducing its effusion, or by producing it in the inflamed part through metamorphosis of the material effused. In other words, an inflamed structure may possess either a secretory, or a formative power.

Virchow adheres to the latter view, and maintains by experimental observations, that irritation induces the effusion of a fibrinogenous substance, which can be converted into fibrin. In proof of the self-sufficiency of irritation, Virchow adduces the operation of a blister; that

\* Cellular Pathology, p. 163.



firstly, serum only is yielded, but if the irritation be more violent, a fluid which coagulates. The general doctrine advanced is thus stated: "A patient who produces at a certain point a large quantity of fibrin-forming substance, much of it passes from that point into the lymph, and finally into the blood. The exudation may therefore in such cases be regarded as the surplus of the fibrin formed *in loco*, for the removal of which the lymphatic circulation did not suffice. As long as the current of lymph does suffice, all the foreign matters which are formed in the irritated part are conveyed into the blood; but, as soon as the local production becomes excessive, the products accumulate, and in addition to the hyperinosis, a local accumulation of fibrinous exudation will also take place."

More consistent with known facts is the operation of a secretory power, by which structures select this or that constituent of the blood as it passes through them, and by which the effusion of that particular constituent is determined. An approach to the proof of this theory is, I conceive, the behaviour of the same blood in different textures. Blood, having the same composition and properties, deposits in one inflamed part much fibrin; in another, rather albumen; in a third, more fatty matter. In pleuro-pneumonia, for example, fibrin and a large proportion of serum are effused from the inner surface of the pleura; an albuminous matter is deposited in the lung-parenchyma; and pus, in which fat abounds, is more readily secreted from the (bronchial) mucous membrane. These products are known ingredients of the same blood, flowing alike to each of the three structures mentioned, and yet they severally receive a different kind of deposit. The inference is, that the particular deposit is selected or secreted by the particular kind of texture. How far this secretory power is a vital property; how far it results from the physical construction of the texture, is an open question. Assuredly the physical consistence and permeability of a part will very much affect its capability of receiving this or that kind of effusion.

Probably all the causes of effusion co-operate. The "composition and properties of the blood," the "hydraulic state of the circulation—both local and general," the secretory power of the "structure," and perhaps "nervous influence," are each engaged; and sometimes serum is the prevailing product, sometimes fibrin, as I have explained. This latter soon coagulates, and the effusion, at first fluid, assumes the physical character of a mixed product—partly solid, partly fluid, varying in this respect as either fibrin or serum prevails.

Pus is a new product; but its evolution appears to be governed by conditions analogous to those which regulate the formation of other inflammatory products, and those of nutrition in general. "Secretory power" is in operation, regulated probably by "nervous agency," and determined by the "condition of the blood;" possibly also by the "flow of that blood to the part."

Pus has been termed a secretion; and its constant production in connexion with certain textures, rather than others, although the blood be the same, plainly indicates that such parts possess and exercise some secretory power.

The readiness with which mucous membranes suppurate is well known. Bronchitis, enteritis, and cystitis are prone to induce purulent sputa, fæces, and urine, respectively; indeed, pus has been found on a bougie five minutes only after it was introduced into the urethra. Other

textures are far less prone to suppurate. An incision through the skin and subcutaneous cellular tissue probably unites by adhesion, without any suppuration, or pus is not produced for two or three days.

Observations such as these tend to establish the theory, first advanced by Simpson,\* that pus is a secretion. Certainly it is as much so as cuticle and all other tissues. They are evolved from a blastema, effused from neighbouring vessels; and pus is also the product of a blastema, but which is effused by inflammatory hyperæmia. The doctrine of pus-secretion was likewise suggested by De Haen; and a few years afterwards, Dr. Morgan† fully discussed the whole question. Brugmann‡ followed with a similar view; and at length Hunter§ adopted and supported this secretion theory, without, however, having first suggested it, as is sometimes asserted.

The pus-forming power of textures is probably regulated, like other secretory power, by the nervous system. In paraplegia, cystitis usually ensues, and this paralytic cystitis produces purulent urine in a more marked degree than cystitis arising from other causes. Injury of the fifth pair of nerves is followed by suppuration of those parts which they supply. Such cases show the effect of intercepting the nervous influence to a part; but the nervous system exhibits its influence by inflammation and suppuration of a part through sympathy with some irritation in another and perhaps distant part. Mr. Paget refers to a specimen|| where extensive deposits of lymph and pus were found in the testicle of a man whose urethra contained a portion of calculus impacted after lithotomy. Analogous cases are on record. The influence of mental emotion in producing inflammation with speedy suppuration is manifested by the following case,¶ and of which there are similar ones. A lady was watching her little child at play, and she saw a heavy window-sash fall upon its hand, cutting off three of its fingers. In a short time the mother also had inflammation of the corresponding three fingers of her own hand, and in twenty-four hours pus was evacuated by incision.

Pus-production is determined very much by the condition of the blood. One would suppose so, judging from the analogy between pus-secretion and other efforts of the secretory power. Certain experiments made by Mr. Paget supply apposite illustrations. They show that the same tissue, inflamed by the same stimulus, and as near as possible in the same degree of inflammation, yields, in different persons, and in whom therefore the blood may be considered dissimilar, different forms of lymph. The inference is obvious, that blood-conditions determine the kind of product which shall be formed, or, as we may say, secreted. I have already noticed this doctrine and these experiments. Blisters raised by cantharides in thirty patients gave sometimes a fibrinous, sometimes a purulent product. It was found that in cases of purely local disease, in patients otherwise sound, the lymph formed an almost unmixed coagulum, in which, when the fluid was pressed out, the fibrin was firm, elastic, and apparently filamentous. Whereas, in cases at the opposite end of the scale, such as those of advanced phthisis, a minimum of fibrin was con-

\* *Dissertationes de re Medica*, 1722.

† *Puopoisés sive Tentamen Medicum de Puris confectione*, 1763.

‡ *Thesis de Puogenia*, 1785

§ *Blood and Inflammation*, 1794, p. 417 *et seq.*

|| *Museum of St. Bartholomew's Hosp.*, Ser. xxviii., No. 55.

¶ *Pathology and Treatment of Hysteria*, Carter, 1853, p. 24.

sealed by the crowds of corpuscles imbedded in it. Mr. Paget therefore concludes that the highest health is marked by an exudation containing the most perfect and unmixed fibrin; the lowest, by the most abundant formation of corpuscles, and their nearest approach, even in their healthy state, to the characters of pus-cells.

Has continued determination of blood any influence in producing pus? It has been alleged, that, "such a result is most likely to ensue in complex and highly vascular structures, where the effused matter is retained in intimate contact with the blood-vessels; hence intensity and continuance of inflammation in the true skin, cellular textures, glands, and most parenchymatous organs, pretty surely lead to suppuration."\* And in explanation of this process, it is suggested by the same authority, that, as under the exaggerated "influence of the red-corpuscles (which convey oxygen) on the liquor sanguinis, more of its protein passes into the state of solid deutoxide,—a material fitted for organization and reparation; so we may infer that the excessive degree or continuance of the same action may overdo this change, give chemical properties an ascendancy over the vital powers, and by turning the most recently-formed solid into a fluid tritoxide, may effect a work of separation and destruction, involving the blood in the obstructed vessels, and extending to the albuminous matter of the containing texture."

This chemical theory needs no further refutation than the now acknowledged fact, that protein itself is a chemical myth, having no existence, and of course therefore incapable of forming a deutoxide, and then a tritoxide. But what influence does persistent determination of blood exercise, under the circumstances of pus-formation, in complex and highly vascular structures? If an incision be made when pus is about forming in a large boil, an abundance of solid lymph is seen agglutinating the cellular texture. Pressing as this does upon the vessels which it encompasses, they become, at least partially, occluded. Inflammation being far advanced, "obstruction" is now added to "persistent determination" of blood. And this obstruction, this solid lymph and agglutinated cellular texture, may extend for some distance, giving the external swelling a broad base. Around the periphery of the solid swelling blood plays freely, yet without pus forming there; whereas, in the centre, first appears a white spot of pus, far removed from the circumferential determination of blood. This afflux of blood goes on depositing fresh lymph, thus enlarging the swelling; while in the midst of the solid lymph and occluded vessels, more and more removed from all such external influence, suppuration proceeds. Persistent determination of blood, therefore, only prepares a structure for suppuration; suppuration itself is an independent process. Consequently, we are not surprised to discover pus in a texture where determination of blood cannot have availed much; as in the centre of a large fatty tumour, itself but ill provided with vessels for its own supply of blood; and the freest afflux of blood without suppuration, as in a gouty toe.

*Signs of Effusion, and of Suppuration.*—Inflammatory Effusion is attended with swelling, in consequence of the progressive accumulation of the products of effusion. The nature of this swelling may be recognised partly by considering the physical character of the products; liquor sanguinis presenting a swelling, at first fluid, but as coagulation ensues, it soon assumes the character of a mixed product—solid and fluid, varying

\* Principles of Medicine, C. J. B. Williams, M.D., 3d Edit., p. 364.



as either fibrin or serum prevails. The diagnosis of a chronic swelling of doubtful character, can be completed by puncturing its substance, and if necessary by further examination with the microscope of the very matter effused or the resulting products.

*Suppuration* is announced by a throbbing or pulsating pain, increased heat, redness and swelling. But proceeding as these signs do from increased determination of blood—a condition not essential to suppuration—they are not invariably present, or followed by suppuration; the inconstancy, in either respect, depending on the kind of texture in which inflammation takes place.

In any unyielding texture, inflammation is accompanied with a throbbing pain, without suppuration, necessarily, ensuing; toothache being a familiar example. In a loose parenchymatous texture, which more freely admits the afflux of blood, extensive suppuration may have supervened, without any previous throbbing; as in the cellular texture of the ischio-rectal fossa.

Conversely, with regard to increased swelling;—in loose cellular texture, considerable effusion and swelling may have taken place, without suppuration ensuing; while, in an unyielding texture, an abscess forms, without any previous increase of swelling.

The diagnostic value of these symptoms is perhaps fairly this; when suppuration does occur, in unyielding textures, it is invariably preceded by throbbing, with increased heat and redness; and, in yielding textures, by increased swelling. Otherwise these are not constant signs of approaching suppuration. Consequently, they are not absolutely trustworthy as premonitory symptoms.

But the physical properties of pus confer certain distinctive characters on any soft part in which it is formed. Just as the first effusion of lymph is recognised by a semi-solid swelling, arising from the products—fibrin and serum—into which that lymph has become resolved; so now another product,—fluid, but of creamy consistence, and slightly viscid, imparts a more elastic feel to the swelling. It is the sign of *diffused* suppuration, and this condition may continue, or a further change take place.

*Abscess.*—Lymph may become deposited so abundantly around the focus of suppuration, as to effectually circumscribe and imprison the pus. The textures, thus encompassed, die, disintegrate, dissolve, and are removed by absorption, leaving the pus, more or less pure, in their place. An abscess is formed. The circumferential lymph of this pus-containing cavity, assumes, somewhat, the structure and characters of mucous membrane, and acquires a secretory power. It becomes pus-forming, as well as pus-containing; it is a pyogenic membrane. And as it absorbs old pus, as well as secretes new matter, the abscess is gradually concocted or ripens.

The Signs are now those of abscess. The throbbing pain, heat, and redness, all the signs of previous active hyperæmia, are mitigated by the yielding resistance of pus as compared with that of partially solid lymph; unless the matter be confined under any unyielding-texture, such as a fascia, or within bone. But a fluid and fluctuating swelling is presented, rather than one having the solidity of coagulated lymph, or the greater elasticity of pus diffused.

Like any other structure, pyogenic membrane may lose its functional power; then, pus-secretion failing, while absorption continues and prevails, the abscess dwindles and gradually disappears; or, retaining its



power unimpaired, secretion and absorption are, perhaps, equally balanced, and the abscess remains stationary and becomes *chronic*; or, lastly, acquiring a higher degree of secretory power, pus accumulates, the pyogenic membrane itself grows proportionately, and the abscess enlarges. The pus-secreting sac or cyst, thin and smooth, is gradually transformed into a soft spongy membrane, slightly mammillated, and of a greyish or reddish brown colour, as seen after death. This sac is attached to the surrounding textures loosely or closely. They are detrued and absorbed under constant pressure by the expanding abscess, and thus the area or size of the fluctuating swelling increases.

At length—in a variable period, usually before the abscess becomes chronic—absorption of the pyogenic membrane itself begins, under the expansion of constant fluid-pressure. And, generally, in the direction of least resistance the abscess *points*; the circumferential tissues undergoing absorption more readily, or yielding more in that direction as the expanding force there gains advantage. On the side of the abscess opposite to this thinning portion, the pyogenic membrane, according to Macartney's observations, actually grows thicker, and contracts so as to exercise some degree of expulsive power. A prominent point appears, over which the skin assumes a dark livid tint, and the cuticle is shed in eccentric rings. Here fluctuation is most perceptible. Soon a small slough separates and pus escapes. Thus also in the case of mucous membrane, an aperture is formed; but serous membrane yields with a rent. Distension is relieved, and if the aperture be sufficiently free and dependent, or made so, the matter is discharged or drains away daily, coagulable lymph is effused instead, and forming granulations, it contracts towards the aperture, and gradually closes the cavity of the abscess. The residual abscess is now a healing *ulcer*, and the process of reparation is completed in a period varying from, perhaps, twenty-four hours to days, weeks, or months.

If contraction be incomplete, the sac of the abscess is brought together only here and there, leaving intervening pus-producing cavities; a *multilocular* abscess is formed. Or, the cavity contracts into a long narrow channel, lined with a perfect pyogenic membrane throughout its course, and having an obstinate indisposition to heal; a *fistula* is formed. It is convenient to distinguish a *sinus* by the absence of these characters.

The latter is said to be distinguished from the former, principally, by its having only one opening; a sinus being a long, narrow, suppurating canal, opening externally or internally, and having little disposition to heal. But either such canal is an incomplete fistula; as may be fistula in ano. The minute structure of the walls of these passages, the different appearances of their aperture or apertures, and the modes of their formation, are details, for the most part, of little practical importance, or pertain rather to special and regional pathology.

Sometimes the process, after evacuation, is unhealthy, and without any tendency to heal. The sac secretes a fetid sanious pus, induced probably by the admission of air or by some constitutional disorder affecting the pyogenic membrane, and the production of granulations is delayed. Or, at a later period, when the abscess is reduced to an ulcer, it, like ulcers arising otherwise, may exhibit an obstinate indisposition to heal. From constitutional causes, chiefly, this ulcer may become indolent, irritable, inflamed, or phagedænic.

The function of pus may be inferred from its relation to the process of healing by suppurative granulation, in a healthy ulcer or sore. The cells of pus are either degenerate or immature granulation-cells. If the former, pus represents the superficial portion of organized granulation-matter, which, having lived its time, passes off, just as the outermost epithelial cells are shed. If immature granulation-cells, pus represents the superfluous portion of organizable granulation-matter, which never reaches maturity. This is the more probable interpretation. Compare pus-cells—as unaffected by acetic acid—(fig. 4, cells to the left), with granulation-cells (fig. of granulation-structure, in this work), and their great similarity or identity will be obvious. As immature granulation-cells, pus ceases to be secreted when the granulations come to the level of the skin, for then, the ulcer being filled up, no more organizable material is needed. Suppuration may thus be associated with a restorative or reparative purpose; as in the closing of an abscess after evacuation of its contents, and in the healing of open wounds, compound fracture and dislocation.

The situations where abscess originates are regulated, it would seem, very much by the different kinds of texture. Rarely, if ever, is abscess formed in fibrous or cartilaginous tissues, nor within any serous membrane. The situations where abscess may be found, are very various. It may have extended from its seat of origin to another, and perhaps distant, locality.

Abscess by *translation*, as any such extension is termed, somewhat inaptnly, is favoured by various circumstances; by the difficulty with which pus produced in certain parts, finds its way to the surface; by the comparative facility with which it travels to other parts; by slow progress of the abscess, allowing opportunity for its extension; and by special circumstances conducing, which are peculiar to each case. Examples of such abscess occur chiefly in connexion with the spinal column. Taking them from above downwards; abscess arising from disease of the cervical vertebræ, may present directly forwards behind the pharynx; or it may extend behind the sterno-mastoid muscle to the side of the neck; or into the axilla, or the thorax; from the dorsal or lumbar vertebræ, abscess may present directly backwards, or forwards into the thorax or abdomen; or it may extend downwards—through the aortic opening in the diaphragm, in the case of dorsal abscess—and forwards, between the abdominal muscles, to some point in front of the abdomen; or to the external abdominal ring; or, guided, apparently, by the obturator vessels and nerve, to the obturator foramen, it points in the upper part of the thigh; or, within the sheath of the psoas muscle to the upper part of the thigh, more externally, it appears as *psoas abscess*;—or passing thence lower down, it may point in the popliteal space, the calf, or even as low down as the ankle; or extending, from its seat of origin, downwards, and inwards, into the pelvis; this abscess may point at the side of the vagina, rectum, or sacro-sciatic foramen; or escaping thence, burrow externally between the bone and gluteal muscles, thus presenting in the gluteal region. Abscess by translation is further illustrated, by extension from the seat of origin in the shoulder joint to the elbow; or from the hip to the knee. [P. p. 492.]

The Signs of any such abscess are; a fluid, fluctuating swelling, like that of an ordinary abscess; but its concomitant redness, heat, and pain, are absent. Some degree of inflammation may ensue, from the weight of pus on the most dependent part of the abscess, and pain also may be experienced, owing to pressure on nerves in the neighbourhood.

*Hectic Fever.*—The constitutional disturbance or hectic fever consequent on suppuration and abscess, is characteristic. Commencing at a variable period in the course of inflammation, the first symptoms are those of prostration with excitement. A sensation of chilliness or a shivering fit—rigors, announce the one, while the other—nervous excitement—is exhibited by restlessness and sleeplessness, the pulse also retaining its frequency, or rising in rapidity, although losing its force and hardness. The heat and flush of skin subside, a cold clammy sweat supervenes, the urine becomes pale, abundant, and deposits a pinkish sediment of lithates. The tongue loses its brown fur, is white and pasty with a bright scarlet tip; the appetite is very capricious, sometimes absent, with loathing of food and even vomiting; while profuse watery diarrhœa succeeds to the previous constipation. Progressive emaciation and trembling weakness bespeak the failure of nutrition; and the general course of the symptoms at length proclaims the victory of exhaustion.

Hitherto inflammatory fever has subsided uninterruptedly; but if the struggle be prolonged, it acquires an intermittent character,—exhaustion prevailing, yet with recurring efforts of excitement, particularly of the circulation, followed by increased secretions from the skin, kidneys, and bowels. Thus, towards evening, after a day of dread exhaustion and when the skin is pallid, a chill is felt; soon the pulse rises in force slightly, and in frequency to perhaps 100 or 130 beats per minute. Then the patient temporarily revives; the hollow cheeks are crowned with a tint of crimson hue, and the sunken eyes are lustrous; giving to youth and beauty a complexion and an expression which are not of this world. The palms of the hands and soles of the feet feel hot and dry. During the night or towards morning, this fitful fever abates with profuse perspiration, urgent liquid diarrhœa, and probably diuresis. Daylight is welcomed, but only with feelings of greater prostration.

Such is hectic fever. Intermittent, it recurs at various periods; frequently as a quotidian, sometimes as a tertian or quartan. Thus far resembling other intermittent fevers; hectic has diagnostic differences. It seldom recurs, as Dr. Thomson observed, at a period perfectly regular, for more than three or four paroxysms. Then recurring at irregular intervals, it may disappear entirely for ten or twelve days; unlike the course of ague. Moreover, the intermissions of hectic are not complete, the pulse still remaining above par, and very easily excited. It is rather a remittent fever. Hectic, therefore, may recur two or three times daily; and a very slight degree of emaciation, a pulse a little quicker than ordinary, with a slight increase of heat, particularly after meals, are sufficient to constitute incipient hectic. These are the earliest symptoms. Rigor is not necessarily the earliest, nor the most constant constitutional announcement of suppuration, and of approaching hectic. This symptom may be present without suppuration and consequent hectic, as the harbinger of an ague fit, or as arising during inflammation from exposure to cold; or from the mere introduction of a bougie into the urethra. On the other hand, hectic fever sometimes supervenes stealthily, without previous rigors.

*Pathology of Hectic.*—The causative relation of suppuration to hectic fever, would appear to be, not through purulent infection of the system, but through absorption of the disorganized textures, and thence proportionate to the progress of suppuration.

Purulent infection is irreconcilable with known facts. Pus often



exists in the body without hectic supervening—as, for example, in chronic diseases of the joints, and in psoas abscess. Probably, however, in such cases absorption is not very active. In other cases, pus is readily absorbed, yet without inducing hectic. A large bubo will sometimes subside in a few days without any symptoms of hectic, and every pus-secreting ulcer is liable to absorb its own secretion, and yet hectic is an unusual concomitant. Purulent absorption, therefore, is not a cause of hectic fever. On the other hand, I am not prepared to assert that hectic ever occurs without suppuration. Assuredly the quantity of pus formed is no measure of the degree of hectic which shall ensue; for after amputation, say, of a compound fracture, a much larger quantity of pus may form eventually, before convalescence, than had been secreted during the period prior to amputation, and yet the hectic shall subside.

Recovery follows the removal of the disorganized part. In some way, therefore, a causative relation exists between the disorganization of a part, and the supervention of hectic. It cannot be that the progressive destruction of nerves by suppuration, and the injury thereby continuously inflicted on the nervous system, gives rise to hectic, for the symptoms are not those of nervous irritation, and, moreover, they are intermittent, or at least remittent. This certainly looks as if some noxious matter was gradually absorbed and accumulated in the blood, until thrown off by a hectic paroxysm, again to reaccumulate. The matter in question is not pus, or if absorbed it does not infect: by exclusion we are led to infer that the morbid matter is probably the *débris* of the disorganized textures. Clinical observations and examinations of the blood in hectic are wanting to confirm this view; meanwhile it is a significant fact, that the urine deposits lithates during the decline of each hectic paroxysm.

This interpretation of hectic indicates the relationship existing between the progress of suppuration and itself.

If hectic arises from absorption of disorganized textures; then, it must increase with the progressive formation of pus: not that pus, in such case, itself infects, but because its formation necessarily implies the concurrent and corresponding absorption of the encompassing textures, and by thus poisoning the blood, induces hectic fever. Suppuration and hectic are, therefore, related indirectly, as cause and effect; and moreover, the quantity of pus accumulating or discharged, actually becomes a fair measure of the degree of hectic.

Certain acknowledged principles of preventive treatment admit of explanation by the theory I have advanced. Absorption of the textures is checked when the progressive accumulation of pus is prevented; hence, the importance of making an early, free, and dependent opening, for this equally allows any *débris* of the tissues to escape. Again, absorption of disorganized tissues is altogether prevented by removing them; hence, the necessity for amputation where their destruction is extensive and beyond hope of recovery to a healthy condition. Amputation under these circumstances is often followed by surprisingly beneficial results. As Hunter originally observed, a hectic pulse at one hundred and twenty has been known to sink to ninety in a few hours after removal of the hectic cause. Persons have been known to sleep soundly the first night afterwards who had not slept tolerably for several preceding weeks. Cold sweats have stopped immediately, as well as those called colliquative. Purging has immediately ceased, and the urine begun to drop its sediment.



All these facts and considerations harmonize with the theory, that hectic fever arises from absorption of disorganized tissues. Pus itself sometimes, apparently, enters the circulation, as pus; but this produces very different constitutional symptoms and results; those of *pyæmia*, followed by *secondary* abscesses. The circumstances under which purulent infection arises will be noticed, more particularly, in connexion with that subject. Respecting the symptoms, it may be here summarily stated, that they are still those of a blood-poison, and of a typhoid character, but the exhaustion induced is more speedy, and more overwhelming—more typhoid; and the poison is either not eliminated at all, or insufficient to allow of marked intermissions,—the fever is less intermittent, or more continued, than hectic.

(3.) *Destruction of texture*, as a result of inflammation, comprises mortification and ulceration. Mortification, or the death of a part, receives different names according to the partial and recoverable, or total and irrecoverable, loss of vitality in the part affected; the one condition being named *gangrene*, the other *sphacelus*. Both these terms refer to death of the soft textures, and when this takes place to a limited extent and is accompanied with ulcerative separation from the living textures, it is termed *slough*, and the process, a sloughing of the part; when bone is affected, mortification is called *necrosis*, and the dead portion, a *sequestrum*, and its separation, *exfoliation*. This latter term is sometimes restricted to the detachment of an external portion of bone, in the shape of a thin scale or plate.

*Ulceration* may be conveniently described first, as being in its nature introductory to mortification.

The phenomena of ulceration generally, are these:—A portion of integument having become inflamed, from any cause; after a few days a small piece separates and comes away, leaving a corresponding loss of substance—a chasm, from which a discharge, variable in kind and quantity, issues. Thus, then, the skin, or mucous membrane, with perhaps the subjacent cellular tissue, has undergone a “solution of continuity,” slowly, however, as contrasted with a wound, or other recent breach of texture, and an *ulcer* is formed. Its formation and extension constitute ulceration.

The pathological nature of this process has long been a disputed question. All the explanations advanced may be reduced to two heads.

Firstly.—That ulceration signifies molecular disintegration, liquefaction, and separation of the soft parts, thereby leaving a chasm.

Secondly.—That ulceration is an illustration of the process of absorption, the lymphatics and veins being jointly engaged, more especially the former.

Possibly, both modes of removing the disorganized textures co-operate in ulceration. [P. p. 512.]

Textures undergo certain changes of structure preparatory to their ulceration. The latter is essentially molecular disintegration; but, in so far as it proceeds from inflammation, degeneration of texture prepares the way for such disintegration. And the previous degeneration is generally fatty.

The proper discharge from an ulcer—the product of ulceration, not of a granulating sore—is *ichor*. It is a thin sanious fluid, colourless or slightly yellow, structureless, but mixed with exudation, pus, and blood, corpuscles, and with the *débris* of the ulcerating textures. Hence its variable appearance. Its essential chemical composition is unknown. Ichor cor-

rodes the living tissues, and is thus distinguished from pus, which it often resembles in appearance. Thus also it maintains and extends ulceration.

Ulceration, although itself a destructive process, is sometimes restorative or reparative, in virtue of its purpose. For example, by the pointing of an abscess and the natural formation of an opening for the escape of matter externally, or internally into some channel through which it can be safely discharged,—as through the bronchi, stomach, intestine, or bladder.

*Mortification* is only another mode in which any part of the body may die; a reciprocal relation subsisting between this process of destruction and ulceration. They differ in degree, but are one in kind. Ulceration may be exaggerated into mortification, and this may subside into that. Both are convertible by different gradations of the same process of destruction. Thus, now and then during ulceration, some temporary cause may accelerate the inflammation; a larger portion of tissue undergoes degeneration and dies, than can, conveniently, disappear as discharge, and a corresponding portion, therefore, of dead tissue becomes visible in the shape of slough; instead of having been removed imperceptibly by molecular disintegration and liquefaction, aided by the corrosive action of the ichorous secretion. Accordingly the ulcer presents a rim of slough, and from time to time, another and another, as the margin of the ulcer recedes and enlarges, either by sloughing or ulceration. Of course the sloughs will vary in their depth and extent, sometimes approaching the result of molecular disintegration, sometimes appearing as obviously portions of dead tissue, plainly showing the transition of ulceration to mortification. Small fragments of bone may be detached and cast off with the fluid from an ulcerating surface, and these, observes Mr. Paget, when they are not fragments of tissue detached by ulceration extending around them, are good examples of the transition that may be traced from ulceration to sloughing or gangrene of parts.

The conditions which constitute inflammation, if operating with sufficient duration, end either in ulceration or mortification. And indeed the very fact of pus—a product of inflammation—accumulating in any texture or organ, by progressive suppuration, necessarily implies the death and removal of the occupied portion. The determination and kind of blood, the kind of texture, and the nervous influence on the part, are the conditions referred to; but each or all of them are so modified as to have a tendency to death. The determination of blood may be more intense, or the kind of blood may be that which indicates the operation of some blood-poison, or at least a morbid condition of the blood, as in carbuncle and boil, phlegmonous erysipelas, sloughing bubo, and certain secondary syphilitic ulcerations, hospital gangrene, malignant pustule, malignant scarlatina, and small-pox. Unyielding textures are liable to gangrenous inflammation, owing apparently to strangulation of the capillary vessels, consequent on effusion which cannot be accommodated interstitially. Inflammation of any texture situated beneath one of this kind, as beneath a fascia or tendinous aponeurosis, has also a gangrenous tendency, and thus subpericranial inflammation is soon followed by gangrene and sloughing, exposing the scalp. But inflammation of a loose texture, if a comparatively avascular one, as the subcutaneous cellular tissue, is prone to sloughing, owing apparently to strangulation of the vessels, consequent on the ready accumulation of effusion—*e.g.*, in phlegmonous erysipelas. The influence of the nervous system is shown by the ten-

dency to sloughing from injury to the spine. Mortification of the ankle has thence followed within twenty-four hours. (Brodie.) Ulceration of a part may supervene on injury of the nerves leading thereto; a central penetrating ulcer of the cornea was thus formed in consequence of destruction of the trunk of the trigeminal nerve by the pressure of a tumour near the pons varolii. (Paget.) And in another case, under my own observation, in the Royal Free Hospital, a similar ulcer of the left cornea followed an injury to the posterior part of the left side of the head. There was also considerable injection of the conjunctival vessels, and mucous secretions. These symptoms ceased, and the ulcer healed subsequently, leaving a slight opacity in the centre of the cornea. Other illustrative cases are on record. [P. p. 566.]

The Signs of gangrenous inflammation are,—acute burning pain, instead of the throbbing of approaching suppuration. The redness deepens into purple, and thence to a livid hue, a change of colour due to stagnation of the blood in the dying part. The swelling, moreover, is peculiar, for here the textures are disintegrating and softening, macerated also by the effused fluid in which they are soaked. Hence a flabby softness is presented. Phlegmonous erysipelas, as it advances, well illustrates these signs of gangrenous inflammation.

Their diagnostic value is assured by their constancy and exclusiveness; they are never absent collectively in gangrene resulting from inflammation, nor present collectively in any other disease. Acute burning pain is, perhaps, the earliest or premonitory symptom.

From this condition of local disorganization the *constitutional* disorder at once commences. More insidious, its symptoms resemble those of pyæmia, although differing in degree. A wild, apprehensive look, with great restlessness, are conspicuous; the features and manner at length become more composed, and the face assumes a pallid hue. The skin over the whole body and the tunica conjunctivæ sometimes acquire a peculiar yellow colour. (Brodie.) Utter prostration of mind and of muscular power gradually supervenes, and a quivering subsultus tendinum. The pulse beats very feebly, rapidly, and irregularly, feeling like a rough wire drawn under the finger. The secretions are soon perverted; the skin, at first hot and dry, is now bathed with a cold, clammy sweat; the urine, fetid and scanty, may be suppressed; a brown, rough, dry tongue is accompanied with nausea and a putrid diarrhœa. As the powers of organic and of animal life fail, involuntary excito-motions predominate; spasms and convulsions shake the moribund body, while coma ends in death.

This represents the course of an extreme case of gangrenous inflammation; but, short of it, various degrees of the same constitutional disturbance occur in different cases, and it represents also the constitutional disturbance which proceeds from spreading gangrene.

But the gangrene may cease to spread. The reddish-brown tint of the skin in advance of the dead part becomes brighter and more circumscribed. Shortly, a white raised line of demarcation is seen in the living skin immediately adjoining the dead portion. Soon this line melts away into a groove by ulceration; extending deeper, it forms a fissure, and successively passing down through tissue after tissue at length converges, and completely detaches the whole of the dead part. While the living organism is thus separating itself from the slough, adhesive inflammation precedes the line or fissure of ulceration, and, corresponding to it in



length and depth, simultaneously seals the blood-vessels; so as to effectually exclude any further communication with the dead tissues, and prevent absorption of their *débris*. The typhoid type of fever passes off, and is exchanged for some degree of inflammatory fever, which accompanies the process of separation and detachment of slough.

The typhoid fever of gangrenous inflammation arises, apparently, like hectic fever, from absorption of the disintegrating and dying or dead textures.

This conclusion rests on two species of evidence.

Firstly, the fever arises, and invariably, when mortification has advanced to sphacelus,—*i.e.*, when dead tissues are present; and, moreover, when the veins, in some cases at least, are free to absorb.

Secondly, it begins to subside, and invariably, when sphacelus has ceased to spread,—*i.e.*, when the living organism is separating itself from the dead part, and when adhesive inflammation of the blood-vessels, corresponding to the line or fissure of separation, has intercepted any further communication through these vessels with the dead tissues. [P. p. 526.]

Mortification, itself a destructive process, is, like ulceration, occasionally restorative, or reparative, by virtue of its purpose. It is so in the loosening and evulsion of a foreign body by sloughing of the part wherein it is imbedded,—the natural process whereby a thorn in the flesh is extricated. The spontaneous cure of aneurism, by sloughing, is another example; with many others of similar character. [P. p. 803.]

TREATMENT OF INFLAMMATION, AND ITS CONSEQUENCES.—The earliest occasion for interference with inflammation is determined by considering its purpose with reference to the part affected. If it be reparation of some loss of structure, or the construction of some new and useful mechanism, in connexion with such part; the process should be allowed to run its course, or when inadequate, it should be encouraged by maintaining or superinducing the requisite conditions.

.Reparatively, inflammation is available in the healing of incised wounds or fractures, when the soft tissues or the bone are indisposed to unite by non-inflammatory adhesion. Other instances of this kind are cited at p. 44, and many additional illustrations will occur in practice.

Constructively, the plastic operation of lymph-deposit is available for the opening of an abscess safely from a great depth and by a dangerous route; and here also many analogous cases, additional to those noticed at p. 45, are sure to come under the observation of the watchful clinical observer.

Supplemental to the restorative purpose of inflammation, as viewed productively, the destructive aspect of this process may have a similar character. Thus, ulceration forms an opening for the discharge of superfluous organizable material,—pus; and mortification, by sloughing, is useful in loosening and facilitating the evulsion of a foreign body. Obviously in any such case, if interference be necessary, the destruction of textures can be turned to good surgical account.

Whenever the purpose of inflammation is neither reparative, constructive, nor usefully destructive, the process should forthwith be arrested, or subsequently conducted to a favourable issue.

In accordance with the pathology and causes of inflammation, the following are the general indications of treatment to be observed:

(1) The removal of any exciting cause or causes in operation is the



fundamental rule of treatment; bearing more especially on the arrest of inflammation. The causes alluded to comprise the various kinds of irritant matters—mechanical, chemical, and vital—that were enumerated among the “external” causes of inflammation (p. 39); moreover, any constituent of the organism which has become a foreign body, and morbid products, which are more apt to assume that character. They are the “internal” exciting causes of inflammation (p. 39). The significance of their operation, and the efficacy of their removal, as causes of irritation, are well illustrated in the every-day practice of Surgery. Blood, extravasated and decomposing, is a poison; its evacuation is followed by the subsidence of inflammation and constitutional disturbance. A slough of soft textures contaminates; its withdrawal is similarly beneficial. The extraction of a piece of dead bone will arrest a discharge of pus which had continued for weeks, months, or years, and had reduced the patient to the brink of the grave. Excretions are obnoxious when decomposed, and powerfully irritant to parts not intended by nature for their reception;—as urine extravasated into the cellular texture of the scrotum. And the evacuation of excretions under these circumstances arrests the concurrent inflammation. Hence the efficacy of free incisions in the scrotum in the case supposed. Of morbid products, a calculus in the kidney, provokes nephritis; this inflammation ceases when the stone passes down the ureter into the bladder, and is succeeded by cystitis, which in its turn subsides when the foreign body is removed by lithotomy or lithotripsy. These examples will suffice to enforce the general rule of treatment.

Whenever the exciting cause in operation—whether externally or internally—is removable, the process of inflammation not unfrequently ceases with its removal. Fortunately also the fulfilment of this indication meets the requirements of an already large class of cases, and an increasing class as our knowledge and detection of causes becomes yet more early and exact. It is thus that inflammation of local origin may often be arrested, as compared with that which depends on constitutional causes.

In all other cases the process continues and runs its course to structural results if unopposed. The treatment required is no longer preventive only, but counteractive also.

(2) Removal, therefore, of (*a*) the pathological conditions or elements which, co-operating, constitute inflammation; and of (*b*) its local consequences with their concomitant constitutional disorders.

(*a*) The conditions to be overruled by appropriate remedial measures comprise: accelerated textural productiveness, and consequent accelerated textural waste or destruction of texture; the accompanying determination of arterial blood, and any morbid condition of quality in the blood supplied to the inflamed texture or organ; and perversions of the nervous influence.

Experience has established the remedial efficacy of certain measures, both local and constitutional, and which constitute the “antiphlogistic” treatment. This term having been long since recognised in practice, it may be conveniently retained without implying any theory as to the *modus operandi* of the agents employed.

Local antiphlogistic measures consist in the application of cold, heat, or warmth, with moisture, as in the common bread-and-water poultice or moist spongio-piline epithem; in blood-letting by leeches or scarification,

an elevated posture of the part inflamed; incisions, sufficient to relieve tension; blisters, setons, caustics,—as caustic-potash, mineral acids, iodine, burning heat or the actual cautery, and other strong irritants; pressure.

*Constitutional* or systemic measures include—blood-letting by venesection, purgatives, diaphoretics, diuretics, starvation and the antiphlogistic *régime*, antimony, opium, mercury, wine, brandy, ammonia, and other stimulants; cinchona bark, the mineral acids, and other tonics; cod-liver oil, nutritious diet.

Taking this list of remedial agents, some are of the most opposite character, but they may all be used appropriately, in the course of inflammation generally, in the order enumerated.

**LOCAL APPLIANCES.**—*Cold* is more efficacious in the early treatment of inflammation, and as affecting external parts of the body. It may be applied, according to the degree of cold required, by means of ice, or by an evaporating lotion of spirits of wine and water in various proportions. Lead lotion—the liquor plumbi diacetatis, a drachm or more to eight ounces of water—is another refrigerant, but far less serviceable. The application of cold externally will even reach an internal organ, as the brain in meningitis, through the interposed scalp and cranium; but in all such cases the more intense cold of pounded ice in a bladder is necessary to produce a beneficial effect. To some internal organs cold can be applied directly, as to the stomach in gastritis, by swallowing bits of ice.

The leading fact to be observed in every case is, that refrigeration should be continuous and uniform. This two-fold requirement is best fulfilled by some form of self-acting irrigator. A skein of cotton pendant from a bottle of cold water suspended over the part will supply a constant dribbling stream, and thus answer the purpose very well. Its efficiency is witnessed in preventing or arresting inflammation of the large joints. The best rule for the application of cold is to employ it in those cases where, and so long as, the sensation is agreeable to the patient; otherwise to discontinue it.

*Heat*, moderate, with moisture, is preferable in those cases where cold is uncomfortable to the part, or occasions any shivering sensation. Moist warmth is more advantageous also when inflammation is established, the remedial efficacy of cold being restricted rather to incipient inflammation. Warmth and moisture are conveniently applied in the shape of a light, soft bread-and-water or linseed meal-poultice; or by means of spongio-piline soaked in warm water. The latter surpasses any kind of poultice, which is apt to dry, thus becoming an irritant, and is uncleanly. Spongio-piline is even more retentive of moisture than an equal substance of flannel, and more suitable, therefore, as an epithem.

*Blood-letting locally* is advantageous whenever it appears desirable to make a sudden, considerable, and direct impression on an inflamed part, as the eye in iritis. Leeches, scarification, or cupping are available for this purpose. Leeches can be applied to a part which is inaccessible to the cupping-glass, as the os uteri. But the drawing action of a cupping-glass, the pressure of the atmosphere being removed, penetrates to a greater depth than the abstraction of blood by leeches. Hence cupping is more suitable for inflammation of internal organs, as the kidneys when inflamed.

In employing either mode of topical blood-letting, it should be remembered that hæmorrhage may continue for some time after a leech-bite or cupping. An average-sized leech, when fully distended and ready to

drop off, holds about a drachm and a half of blood, and the amount drawn by a cupping-glass can be watched and measured; but the quantity which flows subsequently should always be taken into account and allowed for, more especially with regard to leeches, the after-hæmorrhage from which is more uncertain—by fomentation amounting to half an ounce, or far more, even spontaneously. A single leech has thus proved fatal to an infant. The hæmorrhage is, perhaps, best arrested by touching the little triangular punctured wound firmly with nitrate of silver.

Dry cupping, or the application of an exhausted cupping-glass without previously using the scarificator, is a method of drawing blood to the surface, without abstracting it from the mass in circulation; yet it may be questionable whether the blood thereby rendered stagnant, is not spoilt for the purpose of any returning circulation. The corpuscles are damaged or destroyed, and this change will, of course, be more likely to occur, the more frequently the cupping-glass is re-applied to the same part; so that the blood might as well be withdrawn from the body, as left partially extravasated with its corpuscles broken up.

*Position.*—An elevated posture of an inflamed part is equivalent to the local abstraction of blood. The determination of blood becomes diminished, and the return of blood facilitated; whereby the quantity in the part is greatly reduced. Elevation of posture has, therefore, the same effect as local abstraction of blood, or will, at least, further aid its effect; and this resource is a good substitute for, or a useful adjunct to, local blood-letting. Its efficacy is witnessed in the treatment of inflammation affecting different parts of the lower extremity; as in compound fracture of the leg, dislocation or disease of the knee-joint, and other morbid conditions.

*Incisions* are appropriate to relieve tension; this being caused partly by distension of the blood-vessels in the part inflamed, but principally by the serum effused. Here, then, as with regard to local blood-letting, the guidance of pathology, in the treatment of inflammation, is somewhat available. For the incisions should be made in extent and depth according as either condition of tension predominates. In chemosis, the sub-conjunctival collection of serum suggests the kind of incision necessary. In glossitis, vascular distension is relieved by scarification over the upper surface of the tongue, rather than by one free incision. In phlegmonous erysipelas, both sources of tension are relieved by incisions in different parts of the skin, as the chief seat of vascular distension, and extending down to the subcellular texture, which is engorged with serum. In all cases, however, the requisite length and depth of incisions must be determined practically, by their effect in relieving tension.

Incisions for the discharge of pus and slough will be considered in a subsequent part of the treatment of inflammation.

*Irritants.*—Blisters, setons, caustics, as potass-fusa, the mineral acids, iodine, burning heat or the actual cautery, and other strong irritants, are remedial measures of much value in the more *chronic* forms of inflammation. Their intensity of action varies, but their kind of action is said to be counter-irritant or derivative from the inflamed part, by exciting inflammation in the neighbourhood of that part. This may be true in some cases. In other cases irritants have the opposite effect, they increase the inflammation in the part itself; either bringing it to a termination by resolution, or by promoting effusion and hurrying on the process to suppuration.



According to the object in view, therefore, we should apply any such agent more or less nearly in relation to the part inflamed, and be guided in our choice of one or other by regard to the intensity of its operation.

A seton consists of a skein of silk, worsted, cotton, or hemp thread ; which is attached to the eye of a needle, three or four inches long, and a quarter of an inch in breadth. (Fig. 5.) The integument is pinched up between the thumb and fore-finger, and the needle passed through, carrying the seton-skein after it ; the needle is then cut off, leaving the lash of threads in the subcutaneous track, and either end hanging out.

FIG. 5.



Inflammation is soon excited, with suppuration ; and this counter-irritation and derivative discharge are established for so long a period as it may be desirable to allow the foreign body to remain. If the needle be not at hand, the seton may be passed by means of a common probe : a bistoury having been passed through the fold of integument, the armed probe is slid along the flat of the blade.

A few examples will illustrate the remedial value of this class of agents in inflammation, subject to these two regulations. Blistering the skin is very serviceable in chronic and deep-seated inflammation of the bones and joints. In chronic arthritis, the bulky ends of bone which form the knee-joint and their articular cartilages, are most advantageously influenced by the action of blisters, placed above or below the joint. A seton or issue, which produces a constant discharge of pus from the neighbourhood of the vertebræ, is often of signal service in caries of the bodies of these bones. When applied to the nape of the neck, the same beneficial effect is witnessed in chronic meningeal inflammation of the brain. Of caustics, the potass-fusa is sometimes useful in similar cases, but it is comparatively seldom employed. I rarely use this kind of caustic, and indeed, it seems to be going out of fashion. Nitrate of silver, lunar caustic, promotes the resolution of a whitloë, a bunion, a hordeum or sty in the margin of the eyelids ; and such like intractable conditions of inflammation. Of the mineral acids, as caustic appliances, nitric acid, undiluted, is of great service for converting phagedænic ulceration into inflammation with healing granulations ; but this is scarcely an appropriate illustration as to the treatment of inflammation itself. Iodine "paint," consisting of equal parts of iodine, and of iodide of potassium, to two parts of rectified spirit, and four parts of water, is a strong irritant, of considerable value in removing the effusion and indura-



tion attending chronic inflammation generally. Various stimulating embrocations, as camphor and ammonia, with olive oil, are thus used. The actual cautery may be resorted to, with marked benefit, occasionally, in cases of deep-seated and chronic inflammation affecting the joints and bones, and especially the vertebræ. Thus also the burning-moxa was formerly in some repute. Placed over the spine, and allowed to burn down, it produces a circular slough of skin about the size of a shilling or half-crown. Several moxæ were sometimes applied in a row, simultaneously. But the remedial efficacy of such a powerful counter-irritant measure as even one moxa, is very doubtful; while the severe and continued pain is a decided disadvantage, and more so in virtue of its tendency to aggravate inflammatory fever.

This consideration, indeed, restricts the use of the more powerful kinds of counter-irritants. Unlike the pain caused by the clean cut of a knife in most surgical operations, the pain induced by strong cauterization is felt when the influence of the chloroform has ceased, although the part itself may be killed outright. "It deserves full trial," observes Mr. Simon,\* "whether every intense, and consequently painful form of counter-irritation, might not be superseded by the employment of other means, less intense, but more extensively applied; whether, for instance, ten inches of poultice, may not be equivalent to four inches of blister, or to one inch of issue." In respect to thoracic inflammation, for example, where blistering is employed as a matter of routine practice, the unsurpassed clinical authority of Professor Skoda pronounces such treatment to be always useless, sometimes hurtful.

Re-investigation, therefore, is more especially needed here; further experience, guided, if possible, by the light of pathology.

CONSTITUTIONAL REMEDIAL MEASURES.—*Systemic blood-letting*, by venesection. This mode of depletion has fallen nearly into disuse, in the treatment of inflammation.

The explanation of this change of practice on the part of the Profession generally, is referable to two entirely different views, each having its partisans. According to one school, so to speak, the human constitution has itself undergone a great change in the loss of vital power, whereby febrile symptoms have altered from an inflammatory to a typhoid character. The late Dr. Alison† was the champion of this doctrine. On the other hand, it is contended, that the principle on which blood-letting had hitherto been practised is opposed to Pathology; and that our more advanced knowledge of this science has led to its abandonment. This explanation is offered and ably advocated by Dr. J. H. Bennett.‡

Assuredly the change of practice has taken place, and experience sanctions its propriety. As to its interpretation; probably in regard to this, as to many vexed questions, both parties are partly right, and partly wrong.

But it is not only in the present as compared with former practice, in one period as compared with another, that differences of opinion have prevailed respecting the remedial value of general bleeding in inflammation; it is no less remarkable—as Mr. Simon observes—that contemporaries living under the same sky, and practising in the same year on the same disease, have waged controversy on this subject; and not unfrequently it has seemed probable that medical juries, inquesting any

\* Op. cit., p. 103.

† Edin. Med. Journ., 1856, March.

‡ Principles and Practice of Medicine.

given dead patient, would divide in equal numbers, whether much bleeding or little bleeding had killed the man.

In explanation of this anomaly the same author urges; that, practically, all impartial observers seem now to agree, that while there are inflammations which bleeding can relieve, yet there are also inflammations which every act of depletion, instead of diminishing, will increase. And the obvious inference from this fact is one which, certainly, the pathology of inflammation would indicate; that the therapeutical value of blood-letting does not so much consist in its directly controlling inflammatory excitement, as in its controlling some condition, which may or may not be concomitant.

What then is this condition? Reserving for a moment that which Mr. Simon suggests, I would first notice another.

Forcible contractile action of the heart, with a strong pulse, undoubtedly maintains the local determination of blood; although this latter may be aided by the accelerated nutritive changes of the part itself, using up the plasma supplied, and thereby continuously eliciting exudation from the capillary vessels.

General blood-letting, by venesection, powerfully relieves the action of the heart, even to syncope. But, with inflammatory fever, the system is more tolerant of loss of blood than in health, or other diseases. This increased tolerance was first clearly shown by Dr. Marshall Hall, the results of whose investigations are given in the following table, which represents as compared with health, the mean quantity lost before incipient syncope is induced, the patient being in the sitting or the erect posture:—

#### 1. Healthy Tolerance:

This depends on the age, sex, strength, &c., and on the degree of thickness of the parietes of the heart; but it is about . . . . .  $\frac{3}{4}$  xv.

#### 2. Increased Tolerance:

Congestion of the brain . . . . .	$\frac{3}{4}$ xl—l.
Inflammation of serous membranes . . . . .	} $\frac{3}{4}$ xxx—xl.
Inflammation of synovial membranes . . . . .	
Inflammation of fibrous membranes . . . . .	
Inflammation of the parenchyma of organs— brain, lung, liver, mamma, &c. . . . .	$\frac{3}{4}$ xxx.
Inflammation of skin and mucous-membranes, erysipelas, bronchitis, dysentery . . . . .	$\frac{3}{4}$ xvi.

#### 3. Diminished Tolerance:

Fevers—eruptive and others. . . . .	$\frac{3}{4}$ xi—xiv.
Delirium tremens, and puerperal delirium . . . . .	$\frac{3}{4}$ x—xii.
Laceration or concussion of the brain . . . . .	} $\frac{3}{4}$ viii—x.
Accidents, before the establishment of inflammation . . . . .	
Intestinal irritation . . . . .	
Dyspepsia, chlorosis . . . . .	$\frac{3}{4}$ viii.
Cholera . . . . .	$\frac{3}{4}$ vi.

The condition to which Mr. Simon refers as deserving especial notice, is that state of the vascular system, which, often designated “vascular tension,” is characterized by a hard pulse.

Both these conditions—forcible action of the heart and vascular tension—are alike diminished by general bleeding; the pulse becoming weaker, slower, perhaps more regular, and softer.

The propriety of having recourse to this reducing measure should

therefore be determined and regulated by reference to the state of the general circulation, as indicated by the characters of the pulse in respect to its force and hardness. But the necessity for blood-letting is proportionate also to the physiological importance of the organ affected, which might otherwise be permanently damaged by the structural results of inflammation; and the urgency on this ground will be indicated by the functional disturbance which the organ itself suffers and induces by its functional relation to other organs. These conditions of organic significance are not accompanied with a corresponding tolerance of blood-letting. For example, they co-exist in pneumonia, especially double pneumonia; the lungs being highly important organs functionally, dyspnoea and general functional disturbance thence arises. Yet in this disease the tolerance of blood-letting is thirty ounces, as shown by the table, or only double that of health, and less by twenty ounces than that of the highest range in the list.

The effects of blood-letting are more than momentary. This should always be remembered in considering the necessity for producing a powerful and persistent impression on the general circulation. Such impression can be made in either of two ways; the one or the other having a salutary tendency, according to the previous duration of the inflammation.

Recent inflammation may be arrested by the loss of a moderate quantity of blood, suddenly—*i.e.*, through a large orifice or from both arms simultaneously, and the patient being placed in the sitting posture, so as to induce syncope.

Inflammation of a few days' duration will be more surely brought to a termination by the loss of a larger quantity of blood, gradually; the bandage above the orifice in the vein being loosened, and the patient in the recumbent position, to avert the tendency to syncope. Or venesection may be repeated from time to time, according to the symptoms; thereby renewing and further maintaining the impression originally made on the circulation.

The advantage of gradual over sudden loss of blood, in inflammation of some duration, is evinced by the fact, that if the first impression be thus maintained, it is found unnecessary to repeat it.

Local blood-letting will prove sufficient subsequently, in most cases; and advantageously so, by directly affecting the inflamed part without powerfully and persistently influencing the system. And it should never be forgotten, that the permanency of systemic impression is directly proportionate to the quantity of blood lost. Nutrition is reduced throughout the body, and any process of reparation may fail. Probably the vital injury of excessive blood-letting or of such hæmorrhage accidentally, is never quite recovered from.

*Purgatives* not only remove fæculent matter, which would otherwise be a source of irritation affecting also a large extent of intestinal mucous membrane; but, their operation is depletory by inducing the discharge of serum from the blood. Purgatives are, therefore, a useful adjunct to, or even a substitute for, general blood-letting, in relieving vascular tension. Different kinds of purgatives appear to act on different portions of the intestinal tract; and hence a combination of these medicines may prove more efficient than any one alone. Salts and senna, jalap and rhubarb, are familiar examples of such combinations. It would be very desirable to acquire more extensive and exact knowledge respecting the action of purgatives for this purpose.



But they probably have also different selective powers, in promoting the discharge of different constituents of the blood, and various effete or noxious matters; thus affecting the quality as well as reducing the quantity of the blood in circulation. Here, more especially, further clinical observation would be highly desirable.

Besides removing irritant matter, and having a depletory and an excretory operation, purgatives are said to have a derivative action, apparently by inducing hyperæmia of the intestinal mucous membrane. In this way they are supposed to antagonize inflammation of the brain, for example. But it is a kind of action which prohibits the continued use of purgatives, lest intestinal inflammation be superinduced.

The purgative operation of mercury is referable to its agency in promoting the secretion of bile,—itself a natural purgative. Besides, however, having this effect, the “cholagogue” action produced by larger doses of mercury is equivalent to general blood-letting as a depletory, and superior as an excretory, remedy; for the copious spinach-like evacuations produced are equally effectual in reducing vascular tension, and are specially excrementitious, without unnecessarily diminishing the quantity of blood in circulation. Calomel, in doses of five, ten, or twenty grains, and repeated as occasion may require, is perhaps the best cholagogue.

The action of mercury on the liver as a secreting and excreting organ, suggests a general inquiry respecting the action of other purgatives, specially on the glandular apparatus of, or associated with, the gastro-intestinal organs. What medicines specially affect the secretion of the pancreas; what, with regard to the glands of the gastro-intestinal mucous membrane; namely, the tubular, the cardiac, and the lenticular glands of the stomach; the glands of Brunner, the crypts of Lieberkuehn, and Peyer's glands, of the small intestine; and the innumerable follicles of the large intestine?

*Diaphoretics* and *diuretics*—medicinal agents which increase or alter the secretions of the skin and kidneys, respectively—are purgatives in their way. They are depletory, excretory, and derivative. Such is the acetate of potash, a diaphoretic, and the nitrate of potash, a diuretic. Little or nothing is known of these, and similar medicines, in their intimate relation to inflammatory fever. Experience alone sanctions their use. Their administration constitutes what is more particularly designated “febrifuge” treatment. A liberal allowance of water, soda-water, or other bland fluid, seems to favour the excretory operation of these medicines; probably by diluting, and, as it were, washing away effete matters from the system.

*Starvation* is another kind of depletion, by withholding the supply of nourishment. And if this were all that the term suggests physiologically, its significance therapeutically in relation to pathology, would be very simple. But starvation has reference to many differently constituted textures; each undergoing its own nutritive changes, and having its own food requirements. Consequently, the starvation of any one kind of texture, and kindred textures, is physiologically possible without, at least proportionately, depriving others of their food. Thus, the albuminoid textures, of which muscle is the type, might be starved, apart from the gelatinous, as skin and mucous membrane; and these again apart from osseous texture. The various artificial preparations of food have not, however, hitherto reached this desideratum of composition, for the purposes of therapeutic treatment, yet it would bear very directly on inflam-



mation,—accelerated nutrition,—as affecting different organs and their component textures. The “antiphlogistic regimen” is rather a negative than a positive regimen. Dietetically, it consists in abstinence from animal food and stimulating drinks, and in the moderate use of bland fluids, as barley-water, gruel, arrow-root. But it also implies the exclusion of all surrounding circumstances of excitement to mind or body. A cool and well-ventilated apartment, an easy bed, exclusion of light and noise, the prohibition of conversation, of the constant presence and attention of friends, and the banishment if possible of care; such are the principal features of this regimen.

*Antimony*, as an internal remedy, most nearly resembles general blood-letting. After a dose of say, half a grain, repeated or increased to one or even two grains, every three hours, until vomiting occurs; the effect on the circulation and secretions are very marked. At first, the pulse becoming more rapid and feeble, it dwindles down to a fine thread. Then, vomiting having occurred, the pulse loses its frequency, and perhaps regains its force, but acquires a peculiarly full and soft character; showing that vascular tension is overcome or relieved. Simultaneously, perspiration and the secretion of urine are notably increased; and liquid evacuations from the bowels not unfrequently accompany this relaxation. The muscles also are flaccid and powerless. In short, the whole muscular system, voluntary and vascular, is relaxed; and a flux or flow takes place from various secreting organs, which further reduces the vascular tension. Any local inflammation is thus materially diminished.

A full dose of tartarized antimony having this result; similar effects, though in a less marked degree, and without the distress of vomiting, may be produced by smaller doses. Fortunately, however, vomiting soon ceases, while the beneficial influence continues with the full administration of the medicine; or this symptom may be controlled by administering it in the form of a saline draught with four or five minims of diluted hydrocyanic acid. The action of this remedy is most salutary when even nausea is not induced.

Antimony will be most advantageously prescribed after general blood-letting to maintain its effects, and in proportion as the vascular tension, indicated by hardness of the pulse, continues. But either resource may be considered a substitute for the other; and experience gives the preference to antimony, generally. It is found to be most effectual in pneumonia, orchitis, and inflammation of other unyielding textures; less so with regard to serous membranes; and it is contra-indicated in enteritis.

*Opium* is of signal service in the treatment of inflammation. It seems to act partly like antimony and blood-letting by overcoming vascular tension, but opium has the advantage of also subduing nervous excitement. Its administration is, therefore, most appropriate when this is the predominant element in inflammatory fever; or when excitement of the circulation declining, that of the nervous system with general weakness become prominent. It is thus that opium proves so beneficial after severe injuries or surgical operations; where shock is followed by excessive reaction, or prostration with excitement prevails over or outlasts inflammatory fever.

In some cases, opium acts specially on the part injured or operated on, as by paralyzing the peristaltic movements of the intestine after the operation for strangulated hernia. It seems also to influence, in some

way, favourably, inflammation having an ulcerative or gangrenous tendency.

The chief disadvantages attending the use of opium are ; the sickness it is apt to occasion at first, and constipation by its more continued use. The latter can be controlled or prevented by our next remedial measure, prescribed in combination with the opium.

*Mercury* counteracts the constipating tendency of opium, and this, in its turn, overrules the aperient action of mercury ; either medicine checking the intestinal influence of the other. The combination generally employed is calomel and opium ; in the proportion of from one grain to five of the former, with a quarter of a grain to one grain of the latter, given as a pill every four hours or so.

But does the continued administration of this familiar formula produce any remedial effect, through the systemic influence of mercury ? This is debateable ground. Unquestionably, mercury can be introduced into the system—meaning thereby the blood in circulation—and it then produces peculiar symptoms ; the gums becoming red, spongy, and tender, the breath having a peculiar fœtor, and a metallic taste being experienced like that of copper in the mouth. The salivary glands under the tongue and at the angle of the jaw become somewhat swollen and painful, and the secretion of saliva increased. This associated group of symptoms, constituting “salivation” or ptyalism, announces that the system is under the influence of mercury. Mercurial infection, or “mercurialism,” as it is called, is in fact attested by the supervention of certain symptoms ; just as the introduction of the syphilitic virus, for example, is followed, in the course of time, by enlargement and ulceration of the tonsils, some definite skin eruption, and perhaps iritis ; symptoms declaring the syphilitic infection to have taken place.

So far then there are certain effects, specially due to the systemic influence of mercury.

Formerly, also, and until recently, it was unanimously held, that the same influence prevented or retarded the effusion of fibrin, and promoted its absorption. That, “the constitutional action of mercury opposes the organizing efforts of inflammation,” is the somewhat equivalent expression of Mr. Simon. Does this represent the remedial virtue of mercury in the systemic or constitutional treatment of inflammation ? A good illustration of such influence was supposed to be, the visible disappearance of lymph in iritis, apparently under the operation of mercurialism.

Long as this therapeutic theory prevailed, and practice accordingly ; there are reasons for doubting the accuracy of the one, and the efficacy of the other. That mercury exercises some kind of influence over nutrition, there can be no doubt ; but it is questionable how far the natural course of inflammation, having induced the effusion of fibrin, may itself tend to absorption, apart from the co-operation of mercury. Mr. Simon limits the agency of mercury by the following qualifications ; that, “if mercurial cachexia in its lesser degrees, and independently of the purging which may attend it, has a real effect on inflammatory products, this effect probably relates only to such products as are not organized, and perhaps is nothing more than the giving of some special assistance to the dissolution and removal of fibrin.”

Further clinical investigation is needed to determine the question at issue.

Assuming the systemic influence of mercury upon inflammation; its remedial operation can be insured only, by employing it in a certain class of cases, and with certain precautions.

Both these practical requisites are generalized by Sir Thomas Watson, thus:—

“In common adhesive inflammation, whether of the serous or areolar tissues; whenever, in fact, you have reason to think that coagulable lymph is effused, and mischief is likely to result from its presence, then you may expect benefit from the proper administration of mercury; as an auxiliary, however, to blood-letting, when blood-letting is indicated, not as a substitute for it. . . . Previous blood-letting renders the body more readily susceptible of the influence of mercury; and the operation of the mercury comes in aid of the salutary effects of the abstraction of blood. The two remedies accomplish by their joint power what neither of them might be able to accomplish singly.”

“On the other hand, mercury is likely to be hurtful in those forms of disease, where the morbid action approximates to its own action; in cases of erysipelatous inflammation having a disposition to gangrene; in scrofulous diseases; in inflammatory complaints attended with general debility, and an irritable condition of the nervous system, or a manifest tendency to take on a low and typhus-like character.” On behalf of the scrofulous diathesis, it is added; that moderate salivation may prove salutary during an attack of common inflammation; and as surely injurious if the inflammation be scrofulous.

“When we have to contend with acute inflammation, and desire to prevent or arrest the deposition of coagulable lymph, our object is, after such bleeding as may have been proper, to bring the system as speedily as possible under the specific influence of mercury.”

“We know that the whole system has been brought under the specific influence of mercury, as soon as its effects become even slightly perceptible in the gums and breath of the patient; and in adults we cannot be sure of it before. These symptoms are enough; you need not in general look for any more decided affection of the mouth, such as ulceration of the gums, swelling of the glands beneath the jaw and the tongue, and a profuse flow of saliva. . . . All that is requisite is, that the gums should become distinctly tender, and that the mercurial fœtor should be unequivocally manifest, and that these symptoms should be kept up for a certain time. Now this is best effected, usually, by giving some form of mercury in equal and repeated doses by the mouth. For urgent cases, calomel is the best form in which it can be administered; two or three grains given every four or six hours, will generally suffice to touch the gums in the course of thirty-six or forty-eight hours. If it act as a purgative, its specific effect upon the whole system will be postponed by that circumstance; and it then becomes expedient to combine it with just so much opium as will prevent it passing off by the bowels. A quarter of a grain of opium with two grains of calomel or a third of a grain of opium with three or four grains of calomel, will generally be sufficient to restrain the purgative operation of the latter. When a speedier effect is desirable we give larger doses; such as five or ten grains every three, or even every two hours; or we combine mercurial inunction with the exhibition of calomel by the mouth. It is impossible to lay down any precise rule that will fit all cases. Blue pill, or else the



hydrargyrum cum creta, may, in certain cases, be preferable to calomel; but they must be given in greater quantity."

"Mercury is of great service in many cases of chronic inflammation; and I may repeat here the observation I formerly made when speaking of blood-letting—that the treatment must keep pace, as it were, with the disease. When textures have been slowly altered by a gradual deposition of coagulable lymph, we should gain little or nothing by suddenly or speedily salivating our patient. The lymph, if it can be dispersed at all, must be gradually taken up again: and mercury, given with the view of promoting its absorption, must be slowly and gradually introduced into the system, and its specific influence, when at length it is felt, must be sustained for a considerable length of time."

Certain evil consequences are apt to follow the use of mercury. In fact, the symptoms of systemic infection by this mineral have a general resemblance to those of constitutional syphilis, or systemic infection by the syphilitic virus. But as, in most cases, the unfavourable action of mercury is fairly attributable to its immoderate or prolonged administration—an error of rare occurrence, now-a-days—it is scarcely necessary to consider the treatment of mercurial poisoning.

Profuse salivation is, however, an exception which merits attention. Some persons are very easily salivated. In one case—related by Dr. Farre—a lady was affected furiously, in a few hours, by two grains of calomel; prescribed as a purgative with some cathartic extract. She died at the end of two years, worn out, and having lost portions of the jaw by necrosis. Intense salivation is best relieved by the application of a few leeches to the swollen and painful glands. Smearing the gums with powdered tannin, will probably reduce their engorged condition, and give additional comfort. Gargling the mouth with weak brandy-and-water is another resource, not unfrequently successful in relieving the distress. Chlorate of potash, taken internally, is spoken of very favourably by Herpin, M. Ricord, M. A. Fournier, and Mr. Simon, as far as his trials of it have gone. The doses given were commonly ninety grains during the day; and it is expressly stated, that, while the inflammation of the mouth was thus effectually cured, the therapeutical influence of the mercury was in no degree diminished.

On the other hand, some persons are very difficult to salivate. Such cases are not uncommon, and unfortunately they seem most apt to occur when the controlling agency of mercury is most urgently required. In syphilitic cases of obstinate resistance to mercurialism, Mr. Simon finds that this insusceptibility often gives way, if tartarized antimony be administered in conjunction for a day or two; a half-grain dose, and then a few quarter-grain doses at eight-hour intervals.

*Stimulants.*—Wine, brandy, ammonia, or other stimulants, are necessary; whenever inflammatory fever has passed into a state of general depression and exhaustion, the natural sequence of nervous and vascular excitement. Requisite, therefore, as stimulants may be in proportion to the weakness manifested at even an early period; they are sure to become indispensable as the fever itself subsides. And on account of the local condition also, stimulants may be appropriate. When, in the course of inflammation, productiveness predominates, in the shape of effusion and suppuration, it will be necessary to support the circulation under the demand then made; and when destructiveness



predominates, it will be even more imperative to sustain all the vital powers under the influence of poisonous matters absorbed in the course of suppuration, pyæmia, ulceration, or sloughing.

The "genuine effects of stimulation" are thus generally enumerated by Dr. Anstie,\* who has made this the subject of elaborate inquiry; but who, it must be confessed, has arrived at conclusions opposed for the most part to those of previous authors, and which are open to farther clinical investigation. The effects observed are eight in number:—"relief of pain; removal of muscular spasm, tremor, or convulsion; reduction of undue frequency of the circulation; reduction of excessive secretion; removal of general debility, or of special fatigue of the muscles, brain, or digestive organs; removal of delirium, or maniacal excitement, and production of healthy sleep; support of the organism in the absence of ordinary food; local increase of nutrition where this is deficient."

In regard to one of these effects, at least,—“reduction of undue frequency of the circulation,” this view of the action of stimulants would be antagonistic to the propriety and efficacy of administering them for the exhaustion consequent on inflammatory fever.

If we would proceed yet farther, and endeavour to analyse the action of stimulants and interpret their operation, physiologically and therapeutically; we encounter greater difficulties, and are led, at present, to the most irreconcilable conclusions. Pereira classes stimulants under the general head of neurotic remedies (acting upon the nervous system), and under the special class of Ganglionics (acting upon the sympathetic system). He adopts the definition of Dr. Billing; “a stimulant is that which, through the medium of the nervous system, increases the action of the heart and other organs, by calling forth the nervous influence, or by facilitating the extrication of it in them.” The definitions of Dr. Neligan,† and Dr. G. B. Wood‡—one of the authors of the “United States’ Dispensatory,” are both to the same effect. On the other hand, Dr. Anstie proposes; “that the use of the word ‘stimulant’ be restricted to agents which, by their direct action, tend to rectify some deficient or too redundant natural action or tendency; and, that agents which produce excessive and morbid actions of any kind in the organism, be refused the name of stimulants, even though smaller doses of them may act in a truly stimulant manner. That, the word ‘over-stimulation’ be entirely rejected from use, as unphilosophical and a contradiction in terms”||

The kind and quantity of stimulant or stimulants appropriate, will vary greatly according to the age, constitutional strength, previous state of health and habits, of the individual. But the consideration of these particulars had better be left to the special experience and judgment of the practitioner.

*Tonics.*—Cinchona bark, the mineral acids, sulphuric, nitric, nitromuriatic, and other tonics; are useful under, perhaps, similar circumstances to those requiring the aid of stimulants, in the treatment of inflammation. Yet these two classes of remedial agents have different, perhaps opposite, effects, in some respects, although it is difficult to distinguish their operation in every particular.

\* Stimulants and Narcotics, 1864, p. 113.

† Medicines, their Uses and Modes of Administration, ed. 4, p. 348.

‡ Therapeutics and Pharmacology, p. 48.

|| Op. cit., p. 161.

A stimulant certainly produces its effects suddenly and transiently; a tonic, its effects more gradually and more permanently. Then again, the chief primary effect of the one, is to quicken the circulation, as manifested by increased rapidity of pulse; while, the chief primary effect of the other, is to strengthen the circulation, and hence an increased force of pulse.

Thus far these two kinds of agents contrast.

Both, however, concur, in restoring the balance of the circulation from the depression connected with or consequent on the subsidence of inflammatory fever; and subsequently, in contending against the exhaustion of continued effusion or profuse suppuration; or again, in overcoming the depression arising from absorption of poisonous matters, in the course of suppuration, pyæmia, ulceration or sloughing.

The mineral acids seem to exercise a special influence on the secretion of the skin, and indeed, the secretions generally. After having administered the sesquicarbonate of ammonia, as a stimulant, with the tincture of bark or the disulphate of quinine, as a tonic, when first weakness supervenes; the ammonia should subsequently be exchanged for,—say, the diluted nitro-muriatic acid; this tonic combination of bark and acid, being the most effectual means of restraining the sweats of hectic fever, and of cleaning the furred tongue in gangrenous typhoid fever. The general improvement is often very remarkable, and permanent.

*Cod-liver oil*, and *nutritious diet*, are naturally associated; the one seeming to renovate the power of assimilation, the other supplying the materials for restoration. Both become appropriate, and nutritious diet absolutely necessary, on the subsidence of inflammatory fever, and during hectic, pyæmia, and gangrenous typhoid fever; whether for the reproduction of new blood and the general renovation of textural nutrition, or for the reparation of any local deterioration of texture, or loss of substance, consequent on inflammation.

Cod-liver oil may be regarded, partly, as a kind of food, supplying a limpid fat which passes easily into the circulation. In the first instance, it is not unfrequently rejected by the stomach or bowels. Beginning, therefore, with a moderate dose, not exceeding a teaspoonful, of pale, transparent, inodorous, and almost tasteless oil, taken twice or three times a day; this quantity may be gradually increased to a table-spoonful. It is best taken in a little milk, as an emulsion, or floating on orange-wine, ginger-wine, or other light cordial. The addition of a little diluted nitric acid is highly recommended by Dr. C. J. B. Williams;\* or if the tendency to nausea be extreme, the thirtieth or fortieth of a grain of strychnine in solution, with each dose of oil, will be found an excellent corrective. A further precaution is, that the oil be taken ten or fifteen minutes after a meal.

The expression “nutritious diet,” can scarcely be defined. It is assuredly the opposite to “antiphlogistic diet.” Nutrition in the abstract, implies an adequate supply of all the proximate elements which form the textures and organs of the body; whereas the demand arising from inflammation must vary with the particular part affected. Nutritious food, of some kind, will be most needed in proportion to the supervention of suppuration, possibly profuse, and sloughing, possibly extensive. And experience, rather than any chemical knowledge, suggests an in-

\* Principles of Medicine, 3rd ed., p. 490.

creased proportion of animal food, with a liberal allowance of ale or porter, as malt beverages, besides alcoholic stimulants.

(b) *Removal of the Local Consequences of Inflammation.*—They are—productively,—effusion and its organization, suppuration, and the formation of abscess; destructively,—ulceration, sloughing and mortification. As connected with inflammation, it would be unpathological to regard these local consequences otherwise than as continuations of this process; terminally, it is true, yet continuations of one and the same process, essentially.

The local remedial measures, therefore, which counteract the constituent elements of inflammation, are preventive of these after conditions.

But the removal of inflammatory products yet remains to be considered. By what special local proceedings can this indication be accomplished?

Two ways of removing any new product, or any former part of the body, are possible. By absorption, and by evacuation; the latter implying some operative interference.

*Effusion*, consisting of serum, fibrin, and exudation corpuscles, may be dispersed by a stimulating embrocation of ammonia and olive oil, or of camphor and soap liniment; by mercurial ointments, such as the unguentum hydrargyri nitratis; by the compound tincture of iodine, or by "iodine paint;" and by spirit lotions. The influence of some of these agents is aided by the friction employed in their application. Pressure, uniformly applied by even bandaging, will also promote absorption; and this may be aided by some stimulating agent used conjointly, as Scott's ointment to an enlarged knee-joint.

Absorption, is however, available only in chronic inflammation.

Incision will be appropriate when the inflammation is acute, and accompanied probably with considerable tension, as in phlegmonous erysipelas. In all such cases stimulating applications are inadmissible; both by reason of their nature, and the time required for their operation.

*Suppuration* becoming inevitable in any case, the secretion of pus should be encouraged, by quickening the inflammatory process. Abstaining, therefore, from the further use of any remedial measures for counteracting inflammation; the formation of pus is best insured by warmth and moisture topically applied, as by a light poultice, or moist spongopiline.

Absorption of pus is possible. Serum, the fluid portion of pus, is thus readily removed. Pus-cells must undergo a preparatory change. They disintegrate and re-enter the circulation; or remaining, in part at least, the broken-down pus-cells aggregate and form a cheese-like matter, which may at length become cretaceous. Instances of such absorption not unfrequently occur, and authentic cases are recorded by Messrs. Hilton, Birkett, and Critchett;\* and one by Mr. Lawrence.†

The probability of absorption taking place, is but little available for any practical purpose.

*Abscess*, or a collection of matter, generally tends to point, and the surgeon should then follow the footsteps of nature.

An incision, whenever and wherever *pointing* presents, and of sufficient extent to make a *free* opening for the evacuation of matter, and

\* Med. Times and Gazette, 1858, p. 295.

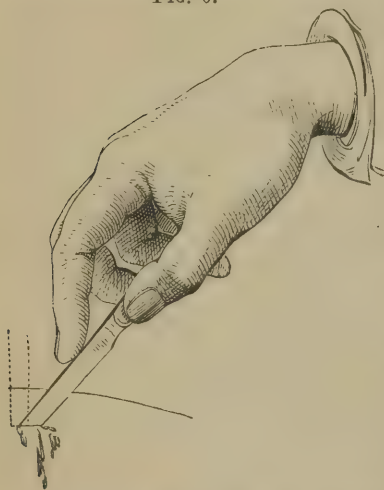
† Surgery, Ed. by T. Holmes, vol. i. p. 142.



its discharge as secreted subsequently; is the rule of treatment. Abscess in certain situations should be opened *early*; indeed, the surgeon cannot be too alert. Thus, in parts abounding with loose cellular texture, as the neck, axilla, groin, neighbourhood of the rectum and vagina, popliteal region, and generally in the cellular planes between muscles. So also suppuration underneath unyielding fibrous expansions, and in the sheaths of tendons. Then again, when adjacent to important organs; as the trachea, pharynx, thorax, abdomen, urethra, and joints. Abscess, moreover, arising from irritant matters; as by the extravasation of urine, or fæces, should be promptly set free. Abscess in situations less accessible, although urgent, perhaps, in other respects, requires some delay; as with regard to the lungs, liver, spleen, kidneys, and most internal organs.

A *dependent* opening, in order to facilitate the after escape of pus, has been particularly recommended,

FIG. 6.



rather than an opening in the situation of pointing. But this practical injunction may be observed too absolutely; for wherever matter points, there, ultimately, an opening will take place. If necessary, however, a dependent *counter*-opening may also be made, to insure the ready discharge of pus as it forms.

To discover the presence of pus, the mode of opening an abscess is important. By introducing a bistoury perpendicularly, a drop of matter wells up along the side of the blade, or a half-turn of the instrument will enable it to do so. The puncture thus made is then readily converted into an incision of sufficient extent. (Fig. 6.)

Thick and flaky pus, and especially when situated deeply, requires a proportionately more extensive incision. Extrusion of any texture, as muscle or fat, hindering the free evacuation of pus, may be obviated by inclining the blade of the bistoury, instead of withdrawing it, as the matter flows.

Hæmorrhage is usually slight and temporary. But in puncturing a deep-seated abscess, there may be some danger. Mr. Hilton, therefore, recommends that an incision be made through the integuments and fascia, so as to expose any muscle under which the pus lies; the cavity of the abscess should then be penetrated by a director, along the groove of which, as a guide, a slender pair of dressing forceps being introduced, the blades are opened, the muscular fibres separated, and free exit is safely given to the pus.

Sometimes, the nature of a swelling or tumour may be doubtful; whether it be solid or fluid, and if the latter, whether an extravasation of blood, or an inflammatory effusion or pus. To clear up the diagnosis, before making an opening with a bistoury to discharge any such fluid matter, it may be advisable to introduce a grooved needle. (Fig. 7.) A



drop of fluid wells up along the groove, or any solid organized material lodged in the groove, is abstracted by withdrawing the needle; and either product can then be examined by the naked eye or under the microscope. I often have recourse to this procedure.

FIG. 7.



The admission of air is generally of serious consequence. Hence some precaution must be observed in opening any *large* and *chronic* abscess. A valvular aperture—as originally proposed by Abernethy—is the best safeguard. Having drawn the skin well to one side, a bistoury is introduced perpendicularly, as usual, but ere the matter has entirely ceased to flow, the integument is allowed to regain its former position; thus obliquely overlaying the aperture in the cyst. The external opening no longer directly communicating with the internal, any matter will continue to drain away without the ingress of air. Moreover, only so much pus escapes as may be discharged by the collapse of the walls of the abscess. When the cavity has partly refilled, the same operation is repeated, and as often as may be necessary for the cyst to contract securely and finally close.

Whether an abscess be acute or chronic, small or large, any thumbing or squeezing would be an unpardonable injury to the delicately organized and highly vascular lining membrane, which previously pus-forming should now become lymph-producing for reparation. On one occasion, having opened a large chronic abscess, situate over the gluteal region, I took the liberty of introducing my finger; deeming it advisable to do so, for the double purpose of turning out the uncommonly thick flaky matter, and of ascertaining whether the cyst communicated with dead bone; the case, a rare one, having simulated either disease of the hip-joint or of the sacro-iliac.

The subsequent escape of matter can, if necessary, be facilitated by the employment of a “drainage-tube,” as recommended by M. Chassaignac. It is a small indiarubber tube with lateral holes; and this pipe may be passed into the abscess leaving one end hanging out, or drawn through the abscess by a counter-opening and both ends tied together. The objection to this proceeding, is the irritation caused by the tube, as a foreign body. In fact it is a seton.

The dressing of an opened abscess should be unirritating. A light poultice may be applied to encourage the discharge of pus, during the process of granulation from within; or the application of a piece of lint to close the aperture, as soon as possible, will be appropriate, when the abscess is to be reopened from time to time.

Abscesses by “translation,” and “secondary abscesses” in the course of pyæmia, should be treated as chronic abscesses; and the more so the larger the size to which they have attained. A valvular opening therefore should be made, and closed with a piece of lint after the tension of the sac is sufficiently relieved, this being repeated when necessary. Obviously such treatment relates only to external, or at least to accessible parts.

*Sinus* and *fistula* require special treatment, in some respects. Any

assignable cause having, if possible, been removed; pressure by a graduated compress and bandage, will succeed occasionally in bringing about adhesion; if the sinus or fistula be recent and accessible. When induration has taken place, or pressure cannot be applied; stimulating injections of sulphate of zinc or nitrate of silver, sometimes answer the purpose. Or a red-hot wire introduced up the passage, may prove successful. This is conveniently accomplished by Mr. Marshall's apparatus; whereby a platinum wire, introduced cold, is made red-hot instantaneously by the galvanic current. Generally speaking, however, sinus or fistula having become indurated, it obstinately resists any attempt to excite adhesion. Slitting up the passage with a curved bistoury, on a director if necessary (Figs. 8 and 9), and healing by granulation from the bottom, must then be had recourse to. A familiar illustration is the operation for fistula in ano.

FIG. 8.



FIG. 9.



The destructive consequences of inflammation—*i.e.*, ulceration and sloughing or gangrene, severally present certain indications of treatment.

*Ulceration*—as depending on inflammation—may be arrested by counteracting any of the constituent elements of inflammation, which are still in operation. Local antiphlogistic treatment—including rest and an elevated position of the part, is indicated. During reparation, the process of suppurative granulation needs little or no assistance. Warmth and moisture, by means of a light poultice, or spongio-piline epithem, may be continued while the chasm is filling up; rest and position being still observed. Superfluous organizable material—pus, is discharged; and when the granulations have grown to the level of the skin, and are no longer suppurative, the aid of a poultice may be discontinued. Water-dressing, simply to exclude the irritating action of the air, is then alone necessary. This application should be exchanged for some slightly stimulating wash, if the pale and flabby state of the granulations suggests the propriety of so doing. A weak solution of sulphate of zinc answers very well. The pressure of a bandage will aid its effect, and repress any exuberant growth.

*Sloughing* and *gangrene*, are, in like manner, amenable to local antiphlogistic treatment, with the view of arresting the process of destruction.

*Effusion*—always an essential constituent of inflammation—is here the element, in particular, to be counteracted or its effect overcome. The relief of tension is imperative. Hence, incisions as free as may be necessary, are the primary indication of treatment. Its efficacy is witnessed in phlegmonous erysipelas and carbuncle.

The process of separation of the living from the dead textures, must

be encouraged. Warmth and moisture, by a poultice or spongio-piline epithem, or the more stimulating action of a yeast poultice, will be highly serviceable, both in limiting the sloughing and inducing the detachment of slough. The latter kind of poultice has the advantage of destroying the factor of decomposing textures. Charcoal in powder, chlorides of lime or zinc, and carbolic acid, are also valuable antiseptic applications. It should, however, be remembered that any stimulant application may over-act, and by hurrying on the inflammation beyond that requisite for the ulcerative severation of textures, would cause the gangrene to spread. The line of separation having formed, the detachment of slough has yet to take place. During this period, its extraction prematurely would be attended with hæmorrhage, perhaps considerable. Nature may be aided gently, from time to time, by slight manipulative interference, here and there.

Finally, the removal of slough is an obvious indication which can hardly be overlooked. Dead soft textures are easily withdrawn by the finger or forceps, a sequestrum will require to be extracted from the encompassing sheath of new bone.

The healing of soft textures, subsequently, is by granulation; and the treatment that for a simple healing ulcer.

Thus ends the local treatment of inflammation, in its consequences, productively and destructively.

The treatment of the concomitant *constitutional* disorders,—hectic fever, arising from suppuration, and the typhoid fever arising from gangrene; is represented by those constitutional remedial measures which come into use as the inflammatory fever declining, is succeeded by general weakness and excitement. Stimulants and tonics on the one hand, with opium; and a nutritious diet, constitute the resources referred to.

*Pyæmia*, also, is amenable to this plan of treatment, if, indeed, it be subject to any remedial measures.

#### VARIETIES OF INFLAMMATION.

The excess or the defect, or it may be, the peculiar character, of one or more of the constituent elements of inflammation, gives rise to corresponding varieties. The principal are as follow:—*sthenic* and *asthenic*; acute, subacute, and chronic; phlegmonous; congestive; erysipelatous; diphtheritic or pellicular; hæmorrhagic; and certain specific inflammations; as the scrofulous, the gouty, and rheumatic, the syphilitic and the gonorrhæal.

The *sthenic* and *asthenic* varieties of inflammation, observes Dr. C. J. B. Williams, are referable to a difference in the strength and irritability of the heart and arteries, and in the quality and quantity of the blood which they propel. *Sthenic* inflammation is marked by a strong, hard pulse, high fever, very fibrinous blood, a full and active development of the chief symptoms of inflammation, and a tendency to the effusion of the more plastic products. Patients affected with *sthenic* inflammation require and bear more antiphlogistic treatment than others; and if used in time, such treatment is commonly very successful, for this form of disorder occurs in subjects of the most robust constitution, in whom therefore the effects of disease are most readily shaken off. *Asthenic* inflammation occurs in persons, the tone and real strength of whose vascular system is low, and whose blood, generally speaking, is poor. The pulse is not always affected; but when it is so, it is in frequency rather



than in strength or firmness; the fever, if there be any, is of a slight, remittent, or low character. The products are either scanty, or of a cacoplastic or aplastic nature; or the effusion may be chiefly serous, the inflammation differing little from flux and dropsy.

*Acute, subacute, and chronic* inflammation properly relate to its duration, but these terms are often used as synonymous with sthenic and asthenic. Acute inflammation may be, and commonly is, sthenic, but its distinctive character is, that it tends to a speedy termination of some kind or other. It may end in resolution, effusion, suppuration, or gangrene, in a period varying from a few days to three weeks. An inflammation lasting above the latter period is termed subacute, and if protracted beyond six weeks is properly called chronic. The latter is commonly asthenic, though it sometimes presents a good deal of the sthenic character. Acute inflammation, when at all extensive, is attended with considerable fever and constitutional disorder. With subacute inflammation the fever is less, and may even be absent. In chronic inflammation there is rarely much fever, and when present, it is of a remittent or hectic kind.

The products of acute inflammation are commonly copious and distinctive, being either free coagulable lymph or pus. Chronic inflammation results chiefly in pus-formation, or in contractile lymph-deposit; while in subacute inflammation, the products are often of intermediate nature, as purulent lymph, or curdy matter.

*Phlegmonous* inflammation is illustrated in the phlegmon or common boil of the skin. Its chief feature consists in its being abruptly circumscribed by an effusion of solid lymph, which brings the inflammation to a termination, either by suppuration, or by slow subsidence, as in blind boils. A highly fibrinous condition of the blood contributes to render inflammation phlegmonous, but this form of inflammation is commonly exhibited by cellular and parenchymatous textures. The type of phlegmonous inflammation is usually sthenic; and even when it advances to suppuration or sloughing, it defends the system against the noxious influence of the pus and dead matter. Hence, the fever is inflammatory, and the local pain, irritation, and heat, are considerable.

*Congestive* inflammation is that in which the accumulation of the blood in the vessels of the affected part, and retardation of its movement, predominate over the determination of blood. Hence it is commonly asthenic, and generally originates from causes that produce congestion, the reaction which converts this into inflammation being imperfect or partial. Its symptoms are less prominent than those of more active inflammation, and partake more of the character of congestion. There may be little pain, heat, or fever; but the redness, where visible, is more marked and deeper than usual, and if the affected organ be very vascular, as the liver, lungs, and kidneys, the swelling may be considerable. Congestive inflammation is usually subacute or chronic, not tending to speedy results; but a kind of flux or dropsy may occur early, as happens from congestion. The solid effusion ensuing is generally cacoplastic; thence the consolidations or indurations resulting, are often of a dense indolent kind, tending to contract or to degenerate still further into aplastic matter. Inflammation of the lung supervening on disease of the heart, on bronchitis, and on asphyxia, is generally congestive; and so is inflammation of the liver, as arising from any cause.



*Erythematic* or *erysipelatous* inflammation contrasts with phlegmonous in its tendency to spread, owing to its not being attended with the effusion of plastic lymph. In its severe form, it is accompanied by much redness, pain or smarting, heat and swelling; the effusion is chiefly serous or sero-purulent, and often raises the cuticle in blisters. It may terminate in resolution; but in its worst form, it terminates in diffused suppuration, sloughing, or gangrene. The fever is asthenic, or even typhoid.

*Diphtheritic* or *pellicular* inflammation of mucous membranes is somewhat allied to the erysipelatous, being diffused and spreading, generally asthenic, and accompanied with a low kind of fever. But it is attended with more soreness than pain, little swelling, and a deep redness, which is early obscured by a characteristic film of grayish or dirty-white albuminous matter, exuded on the inflamed surface. Patches of this kind often occur on the tonsils in sore throat, resembling sloughs. In scarlatina sometimes, diphtheritic inflammation affects the whole throat, and extends even to the trachea and bronchi, and into the mouth and gullet. The films of lymph effused are often foetid, apparently from incipient decomposition.

*Hæmorrhagic* inflammation is attended with effusion or extravasation of blood, in a greater or less degree. It occurs in subjects, scorbutic or affected with purpura, and in connexion with disease of the liver or kidneys. Thus, Dr. C. J. B. Williams has met with several instances of hæmorrhagic pleurisy and pericarditis in conjunction with cirrhosis of the liver, and Bright's disease of the kidney.

The *specific* inflammations will be fully described under their different designations, among Blood-diseases.

TREATMENT.—The treatment of the leading varieties of Inflammation is sufficiently indicated in the general course of treatment relative to Inflammation.

## CHAPTER II.

### TUMOURS OR MORBID GROWTHS.

MORBID Growths present certain general characteristics, in respect to their structure and vital endowments, which may be advantageously noticed, before describing the various species of growths.

1. In common with all other Morbid Products, Morbid Growths are products supplemental, in the sense of being additional, to the parts of the body in which they occur.

2. In their textural structure, and in their physical properties, Growths, generally resemble the various healthy tissues, in which they severally originate. There is a structural homology or at least analogy between the two; and their structural elements are similar if not identical.

But, Growths, in common with other organized Morbid Products, do not generally attain to the same state of textural development as healthy tissues; they so far represent structural retrogressions of the normal tissues to various rudimentary conditions, by arrests of development of their structural elements. [P. p. 93.]

In their degree or grade of organization, Growths represent states of

textural structure, at least as highly developed as the False tissues produced in the Reparation of Injuries or resulting from Inflammation; yet Growths are sometimes regarded as still further deviations from the organization of normal or healthy tissues.

3. A Growth generally presents a well-defined boundary, often a distinct capsule, by which the included structure can be readily distinguished circumferentially from adjoining textures.

By virtue of their structural homology or resemblance to healthy tissues, Growths may perhaps be regarded as hypertrophies or over-growths, but as discontinuous from the surrounding tissues; while, by the latter character, they are distinguished from out-growths or hypertrophies continuous with the adjoining tissues—*e. g.*, out-growing portions of the thyroid and prostate glands.

4. The vital power of Growths is peculiar, and exhibits their essentially morbid character. They possess the inherent power of reproducing their own structural elements, when adequately supplied with blood or plasma as the nutritive material suitable for their production. Hence, I would designate Morbid Growths, products of Reproductive Nutrition. They thus increase and multiply. But, another vital characteristic is this; they apparently fulfil no useful purpose in the animal economy.

"It is not," observes Mr. Paget, "in the likeness or in the unlikeness to the natural tissues that we can express the true nature of Tumours, it is not enough to consider their anatomy, their physiology also must be studied; as dead masses, or as Growths achieved, they may be called like, or unlike, the rest of a part; but as things growing, they are all unlike it. It is, therefore, not enough to think of them as hypertrophies or over-growths; they must be considered as parts overgrowing, and as overgrowing with appearance of inherent power, irrespective of the growing or maintenance of the rest of the body, discordant from its normal type, and with no seeming purpose."

Such are the general structural characters, and such the general vital endowments of Growths, or Tumours.

But the vital changes of certain Growths contrast remarkably with the progress of others.

Some appear to exercise a merely local and mechanical influence; their pathological significance is limited to surrounding parts, which are variously pressed, obstructed, and, possibly, obliterated by absorption. Inflammation, suppuration, and ulceration occasionally occur in parts around, owing to pressure of the tumour, and thus a pendulous growth, more especially, may protrude. Otherwise, the healthy mechanism only of the part becomes impaired by these *localized* Growths.

Moreover, when completely extirpated, as by the surgical operation of excision, they never return. Other Growths are localized, but they are also *recurring*; returning *in situ*, even again and again, when apparently completely extirpated. And yet other Growths are recurring but not localized; they gradually pervade surrounding tissues, and affect neighbouring lymphatic vessels and glands; they are prone to undergo ulceration, and by extension of this process thus destroy adjacent parts. They propagate also in different, and distant regions of the body, and grow in succession and with increasing rapidity. Growths having these vital characters, are aptly denominated *infiltrating* (Walshe) or *malignant*,—a less expressive term; while all other Growths being distinguished by the negation of this generic attribute, are non-infiltrating, or innocent comparatively speaking.

According to the foregoing distinctions, Morbid Growths may be classified as follows:—

Localized Growths (non-infiltrating).

Cysts.

Simple or Barren.

Serous. Sanguineous. Synovial.

Mucous. Oily. Colloid. Seminal.

Compound or Proliferous.

Cystigerous. Glandular. Cutaneous. Dentigerous.

Cystic Tumours.

Fatty Tumour.

Steatoma.

Fibro-cellular Tumour.

Painful Sub-cutaneous Tubercle. Neuroma.

Fibrous Tumour.

Fibro-calcareous. Fibro-cystic.

*Recurring Varieties.* { Fibro-nucleated  
Recurring Fibroid.

Cartilaginous Tumour. (Enchondroma.)

Varieties.

*Recurring Varieties.* { Myeloid. (Paget, or  
Fibro-plastic. Lebert.)

Vascular or Erectile Tumours.

Aneurism by Anastomosis.

Osseous Tumours.

Glandular Tumours.

Infiltrating Growths.

Cancer.

Encephaloid. Varieties.—Villous. Melanotic. Fungus Hæmatodes.

Scirrhus. Varieties.—Osteoid.

Colloid. Varieties.

Cystic Cancers.

Epithelial Cancer. Varieties.

*General Indications of Treatment.*—In accordance with the general pathology of Morbid Growths, and their relations to the developmental anatomy of healthy Tissues, certain general indications of treatment are deducible.

1. To reduce the structural condition to a lower degree of retrogression,—by degeneration or by disintegration, in order to facilitate absorption of the Tumour. Medicinal agents, and local appliances, *e.g.*, stimulating applications, compression, may fulfil this indication.

2. To superinduce some other morbid process, *in situ*, for the direct suppression of the Growth, and its obliteration or destruction as a Tumour. Inflammation, or Sloughing; by stimulant injections, setons, caustics, congelation, may fulfil this indication.

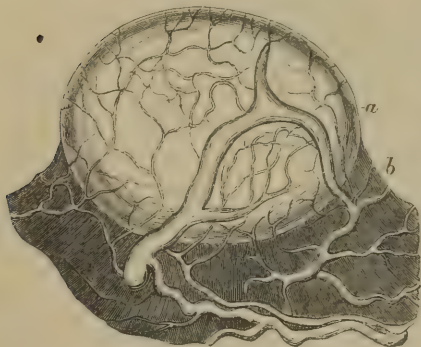
3. To remove the Tumour, as such, mechanically, by surgical operation; puncture, enucleation, ligature, excision, amputation.

**SPECIAL TUMOURS.**—Morbid Growths are severally distinguished by differences or peculiarities, in respect to their structural condition, and physical characters of shape, size, weight, consistence, colour, situation, and number produced; and by their vital history of origin, including,

hereditary predisposition and relations to age and sex; causes—constitutional and local; course, and consequences. In other words, Growths have differences of character—pathologico-anatomical, physiological and pathological, in regard to species. These differences I proceed to describe, and to consider in the diagnosis, etiology, and prognosis, of the various kinds of Tumours, as arranged in the foregoing table. The special Treatment of each will also be described, in illustration of the general indications already enunciated.

CYSTS, and CYSTIC TUMOURS.—*Structural Condition*.—This is very varied. (1) CYSTS.

FIG. 10.\*



Some contain fluid unorganized secretions, and are spoken of as *simple*, or more correctly, *barren* cysts.

FIG. 11.†



"Essentially, this species of growth," observes Paget, is "a cyst, sac, or bag, filled with some substance which may be regarded as entirely, or for the most part, its product, whether as a secretion, or as an endogenous growth." This cyst (fig. 10), sac, or bag, is either solitary, or frequently aggregated with others; and each may be free and moveable, or imbedded in the substance of some other growth, thus forming a "cystic tumour." But the contents of the cyst or cysts are the chief features of distinction.

Others contain organized, endogenous growths, and these are denominated *compound*, or more appropriately, *proliferous* cysts. (Fig. 11.) But the simple sac is the type, from which the proliferous cyst may be regarded as a departure to a more complex condition; and between the former in its simplest condition of development, and the latter in its most anomalous condition, each intermediate variety may be distinguished by the contents of the cysts, and the whole arranged in a tolerably even series of progressive organization.

\* A simple cyst in the broad ligament of the uterus, with very vascular walls. *a*, new vessels; *b*, broad ligament. 30 diam. (Wedt.)

† Proliferous cyst in a mammary gland.—A vascular growth is seen attached to part of the inner surface of the cyst. Below, is a smaller cyst nearly filled with a similar growth. Mus. St. Bartholomew's Hospital. Three-fourths the natural size. (Paget.)



*Simple Cysts.*—A cyst is formed of fibro-cellular tissue, but without an epithelial lining. This is present in the more finished cysts, and is usually the tessellated variety of epithelium. A more perfect secreting surface is thus prepared, and the varieties of simple cysts take their names from the nature of their secretions—their contents. Thus we recognise the *serous, sanguineous, synovial, mucous, oily, colloid, and seminal* cysts.

These barren cysts may be found in almost any part of the body—and to this subject I shall have occasion again to refer in connexion with the origin of cysts—but the seminal cyst has, so far as I am aware, been found exclusively attached to the spermatic cord, and by virtue of the spermatorrhœa which it contains, may be regarded as on the verge of that higher organization which characterizes the proliferous cyst.

*Proliferous Cysts.*—The organized growths within a proliferous cyst are sometimes simple cells, detached, or pedunculated and attached to the interior of the cyst whence they have sprung. Thus are formed the common *cystigerous* ovarian tumours. Occasionally the sub-cysts are found imbedded in the walls of the parent-cyst, or even projecting from its external surface, so as almost to appear of exogenous formation. This mode of cyst-formation is, I think, illustrated by inference from Dr. Mettenheimer's observations on the structure of the common hydatid mole, or cystic disease of the chorion; but for the details of this supposed process the student is referred to Mr. Paget's Lectures.

*Glandular proliferous* cysts are so named from their containing some kind of organized substance or substances, the structure of which resembles some kind of healthy gland-tissue, and for the most part that in which the cysts are imbedded. The thyroid and mammary glands, and perhaps the prostate and labial glands, are the chosen seats of this species of cyst. But a glanduliferous cyst may be developed without any connexion with a secreting gland. A tumour of this kind was removed by Mr. Paget from beneath the gracilis and adductor longus muscles of a woman twenty-five years old. The patient remained well at the end of more than three years afterwards.\* A similar case and operation occurred to Mr. Lawrence.

*Cutaneous* proliferous cysts are so called from their structure consisting of, or containing skin or its remains, with hair, or other forms of epidermic tissue, and fat. These cysts are not necessarily confined to the skin, as sebaceous and atheromatous tumours or wens, but are more commonly found in ovarian tumours; and, very rarely, in the testicle, lung, kidney, bladder, sublingual tissue, and within the skull. Teeth may also be discovered within capsules in abnormal situations, as in ovarian tumours, and the jaws; and such capsules have received the name of *dentigerous* proliferous cysts.

*Diagnosis.*—The distinctive characters of cysts are chiefly physical; their diagnosis from all other tumours being an application of pathological anatomy, through the medium of Physical Signs. [P. p. 224.]

A *simple* or barren cyst, with its fluid contents, necessarily implies a circumscribed and fluctuating tumour, or the resistance only of fluid pressure. Such are cysts,—serous, sanguineous, enlarged synovial bursæ, adventitious ganglia, often seen on the back of the wrist, mucous cysts,—*e.g.*, surcharged Nabothian follicles about the neck of the uterus, or distended Cowper's glands just within the orifice of the vagina, the less

\* Op. cit., vol. ii. p. 74.

fatty cysts,—*e.g.*, certain wens, and seminal cysts in connexion with the spermatic cord—encysted hydroceles. A collection of such cysts presents similar characters; the resistance of the circumscribed fluctuation varying in degree, from that of the most fluid, to that of the most solid-feeling thick fluid; as grumous blood, synovia, mucus, or the butter-like consistence of sebaceous cysts.

Subject to these original deviations, the typical condition of the cystic-growth is that of one or more membranous bags, filled with some kind of fluid; and, as such, its physical characters supply a complete diagnosis, both in respect of exactitude and earliness. An equivocal diagnosis can be determined by puncturing the supposed cyst with a grooved needle or with a fine trocar and canula, and examining its contents, simply by inspection, or under the microscope.

Other conditions—not deviations—are exceptional and subsequent productions:—

The *proliferous* development of a solid growth within a parent-cyst, is an occasional event; especially observed in sero-cystic disease of the breast, and in cystic bronchocele. A tumour, originally fluid and fluctuating, is thus converted into an unbroken solid mass; but during this transitional change, the growth, not yet completely filling the cyst or cysts, is immersed in fluid, so that the whole feels a mixed tumour—partly fluid, partly solid.

Ultimately, if one of the cysts should burst from over-distension, or if it be artificially laid open, the growth within, no longer restrained, increases, and protruding in the form of a fungus, gives to the tumour a new and characteristic appearance.

*Varieties.*—A thickened cyst simulates the characters of other tumours. It may resemble a chronic abscess—*i.e.*, without the pain, heat, and redness of inflammation, only presenting swelling with fluctuation. But a pus-cyst, so to speak, is more blended with surrounding tissues,—it is less circumscribed than a cyst which has merely become thickened. Or, an ordinary cyst is sometimes actually converted into a painless chronic abscess. Their diagnosis is then comparatively unimportant. This also is an occasional and subsequent condition, and one, therefore, not affecting the exactitude and earliness of the diagnosis by physical characters. The sufficiency of the physical method still prevails.

(2) CYSTIC-TUMOUR.—A cyst or cysts within the substance of a solid tumour—renders the diagnosis more obscure; but its equivocal character varies with the particular kind of tumour and the thickness of the intervening substance. Cysts are, occasionally, set in the substance of a fibrous, fatty, or cartilaginous tumour, and perhaps no kind of tumour is exempt.

The depth of integuments, underneath which a cyst may be situated, will more completely conceal its true character.

Apart, however, from exceptional and secondary conditions, the physical signs of cysts are constant. A circumscribed boundary, and fluid resistance, in some degree, to the touch, invariably accompany and announce the presence of a cyst or collection of cysts. These characters are also peculiar;—they point to no other kind of tumour or swelling, except in the cases adverted to. Moreover, they are readily perceived by clinical examination.

*Situation.*—Cystic growths—originating from the erring development of cells or nuclei—may occur in any texture or organ, but most fre-

quently in the kidney, thyroid gland, mammary gland, choroid plexus, chorion; in the neck, gums, about the sheaths of tendons at the wrist,—forming ganglions; and about the epididymis, as seminal cysts, encysted hydroceles or hydroceles of the spermatic cord. (Paget.)

Cysts having this origin are single, or numerous, in the same organ or part.

*Origin.*—Of Simple or barren cysts: the serous date from birth or earliest childhood, as by transformations of *nævi*; or from puberty or later life, as an ovarian tumour by enlargement of Graafian vesicles; or from perhaps still later life, as mammary cysts which begin during or after the time of natural degeneracy of the milk-glands. Of Proliferous cysts: the cutaneous which occur in or near the orbit, are congenital; whereas those which, as wens, occur in the scalp, are not congenital. They are, however, hereditary, though unconnected with any constitutional tendency.

*Cyst-formation*, whether barren or proliferous.—Three modes of production are tolerably well established; but no accurate classification of these growths can be determined upon this ground of distinction. Cyst-formation is as follows;—

Firstly.—By the dilatation and coalescence of the spaces in cellular tissue, a rude cyst is formed, and afterwards finished off on its internal surface, which becomes smooth, and perhaps lined with epithelium. Thus are formed certain adventitious bursæ—*e.g.*, the little sac which Hunter first pointed out underneath the skin of an old corn.

The simple cyst fashioned from areolar tissue may acquire a proliferous power, as witnessed occasionally in adventitious bursæ, from the inner surface of which pendulous little polypi sometimes grow.

Secondly.—By the dilatation and distension of certain natural cavities. Of this kind of cyst are those sacculated enlargements of the lactiferous tubes, filled with milk or serum, which Sir B. Brodie first described as sero-cystic conditions of the mammary gland. But this disease is perhaps more usually due to another mode of cyst-formation, which I shall describe presently. The mode of production now referred to may give rise to cysts in many parts of the body. For example, natural bursæ sometimes enlarge, and become distended with synovia. The bursæ betwixt the skin and patella thus enlarged, and known as “housemaid’s knee,” is a familiar example. Mucous cysts, by enlargement of the Nabothian gland-follicles about the cervix uteri, or of Cowper’s glands in the female, situated just within the vagina, are further illustrations of cyst-formation by dilatation and distension of a natural cavity with its own fluid. Fat-cysts are produced in this way, out of the sebaceous and hair follicles, forming common wens. Graafian vesicles by overgrowth, are evolved into ovarian tumours. I may here notice certain rare kinds of sanguineous cysts, which, from a case related by Mr. Paget, appear as he says, to be “dilated portions of blood-vessels shut off from the main streams.” Of sanguineous cysts thus formed, one was removed by Mr. Lloyd some years since from a man’s thigh. It lay in the course of the saphena vein, but neither that nor any other considerable vein was divided in the operation, or could be traced into the cyst. This cyst was of spherical form, about an inch and a half in diameter, and completely closed; its walls were tough and polished, on their inner surface, it was full of dark fluid blood, and its venous character was manifested by two valves, like those of veins, placed on its inner surface. On one of these a soft lobed mass, like an intracystic

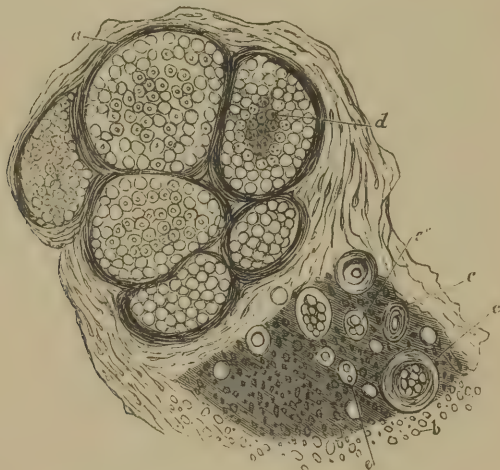


growth is seated. The preparation is in the Museum of St. Bartholomew's Hospital.

This specimen teaches an important lesson; that a simple cyst formed by the expansion of a natural cavity, may become proliferous, and this truth is confirmed by the proliferous power of the lactiferous tubes when enlarged in certain cases of sero-cystic disease of the breast, and the prolific growth of cells in the parent-cysts of an ovarian cystic tumour.

Thirdly.—Besides these two modes of cyst-formation, another mode of production has been discovered, chiefly by the observations of Rokitansky,\* Frerichs,† and Mr. Simon,‡ respecting cysts of the kidney. It would appear that certain cells expand and develop themselves into larger cells, which aggregate together in "nests," each nest becoming enveloped with a thin capsule of fibro-cellular filaments, which thus forms a cyst containing cells.||

FIG. 12.||



But the erring cells themselves may each acquire sufficient size to merit the name of a cyst. The cells which naturally inhabit the villi of the chorion, according to Dr. Mettenheimer,¶ occasionally enlarge into cysts, and form the hydatid mole. From erring cells are sometimes produced serous cysts in the neck, in the thyroid body, in the gums, in the mammary gland, and a cystic condition of the choroid plexus. By this mode of origin, also, may be evolved certain sanguineous cysts,—*e.g.*, in the neck; certain adventitious synovial bursæ,—*e.g.*, ganglions formed in connexion with the sheaths of tendons; and certain seminal cysts. (Paget.)

\* Ueber die Cyste. Wien, 1850. † Ueber Gallert—oder Colloidgeschwülste.

‡ On Subacute Inflammation of the Kidney: Med.-Chir. Trans., vol. iii.

¶ Proliferous cyst-formations from the cortical substance of the kidney, as a sequel to Bright's disease.—*a*, the fibrous sheath in progress of development out of *d*, the elongated and caudate nuclei coursing around the parent-cyst or aggregation of parent-cysts. They eventually break up into the requisite fibres. *c* is to represent the point-molecule, within an amorphous blastema, out of which the nuclei (*b*) form. They are at first spherical, afterwards elongated, and ultimately broken into fibrillation. This constitutes the "alveolar type or arrangement." 90 diam. (Rokitansky.)

¶ Müller's Archiv, 1850, H. v. p. 417.



A surprising proliferous power is frequently manifested by cysts derived from erring cells, of which some instances of cystic diseases of the breast and other glands are probably illustrations. Associated with this power of growth and development, is the well-known fact, that proliferous cysts frequently recur after, as it would appear, the complete extirpation of the original cyst. Mr. Paget relates a remarkable case of this kind, recorded by M. Lesauvages.\* The patient was sixty-three years old. The first tumour of the breast, of great size, was extirpated in February, 1832; a second appeared, and was removed before the healing of the first wound; a third in May; a fourth in September of the same year; a fifth sprang up, and was removed in February, 1833; a sixth in the ensuing May; by a seventh operation, in June of the same year, three tumours were again excised; but from the same spot two more arose, which grew rapidly, and the patient died.

*Course.*—The vital career of cysts, and cystic tumours, is sufficiently indicated by the proliferous changes which cysts, originally barren, may undergo, and their issue, in the protrusion perhaps of the intra-cystic growth. The rate of growth of cysts, and the probability of their recurrence, when removed, or apparently obliterated, vary considerably.

Thus, of Simple or barren cysts; the serous and sanguineous, observe no definite rule of increase, and neither, *per se*, are likely to return. A mucous cyst is more difficult to obliterate, and long after apparent cure, may fill again. Of Proliferous cysts; the cystigerous may be slow growing, as an ovarian tumour, and not liable to recurrence, so also cutaneous cysts—as scalp wens; but cysts proliferous with vascular growths, may grow rapidly, as in the mammary gland, and very frequently return, even repeatedly.

*Treatment.*—Cysts, and Cystic Tumours are amenable to treatment, in accordance with the general indications, 1, 2, and 3. *Simple* or Barren Cysts, containing unorganized secretions of various degrees of fluid consistence, may be effectually reduced by absorption, destroyed, or removed, by one or other of the following modes of treatment:—

Stimulating applications, as the compound tincture of iodine, may induce absorption of the contents of the cyst; and if no re-secretion ensues, a cure will thus be effected. Puncturing the cyst, and drawing off its contents, followed by compression by means of a pad of lint and bandage; is also a curative proceeding of at least a temporary character. But the cyst is apt to fill again, eventually. By this treatment, I succeeded for some time, in controlling two large cysts deeply situated, one beneath the muscles of the calf, the other deep in the popliteal space. The diagnosis also, in these cases, was determined by the preparatory puncture. Puncture, and a stimulant injection, or the introduction of a seton; may succeed in obliterating the cyst by adhesion of its interior, or destroying it by sloughing, and in either way effecting a cure.

Excision of the cyst, is a procedure available when other resources have failed, or more advantageously in the first instance, before the textures have been tampered with by any other treatment. A cyst may have become converted into a painless chronic abscess. I once removed a large cyst, in this condition, from beneath the tensor-vaginæ and sartorius muscles, by an incision eight inches long. The man made a good recovery. [P. p. 233.] Complete excision is rarely necessary to ensure

\* Archiv. Gén. de Médecine, Février, 1844, p. 186.

the non-recurrence of any simple cyst; a small portion left after operation, will granulate and cicatrize. But a cluster of cysts must be removed entirely; otherwise, any one remaining will afterwards continue to grow. Thus, the whole mammary gland, if beset with cysts, must be sacrificed.

*Proliferous Cysts.*—Excision is the only sure and safe mode of treatment; removal of the cyst or cysts entirely, by the knife, being necessary to overcome the productiveness of any such cyst. Cystigerous, and glandular, proliferous cysts, the latter especially, render this proceeding the more necessary. Cutaneous proliferous cysts also are more properly excised. The common scalp-wen, for example, in most instances; and the operation in this case is very readily accomplished. An incision having been made extending down through the cyst, either half can be seized with forceps and easily turned off its bed, the cellular connexion offering very slight resistance. Erysipelas is apt to follow this simple operation, in old or debilitated subjects. It may, therefore, be advisable in such cases, to remove the contents of the cyst by puncture, or even to destroy the cyst by sloughing. If the former mode of treatment be adopted; the introduction of a probe through the small black point existing in most cases, will permit the contents to be squeezed out of the cyst, which may then be made to heal from the bottom, by the substitution of a few threads as a seton. Or if it be desirable to induce sloughing of the cyst, this can be effected by introducing a stick of caustic potash, and turning it about a few times, or by pencilling the skin over the cyst. In either way the cyst is laid open when the slough separates, and heals from within. Nitric acid and other powerful irritants are useful for the same purpose.

*FATTY TUMOUR.*—*Structural Condition and Diagnostic Characters.*—This growth is of soft doughy consistence, defined or circumscribed, deeply and largely lobulated (Fig. 13), and freely moveable; sometimes shifting from its original locality owing to the looseness of its connexion; often attaining to a large size and great weight, even to fifty pounds; usually

FIG. 13.\*

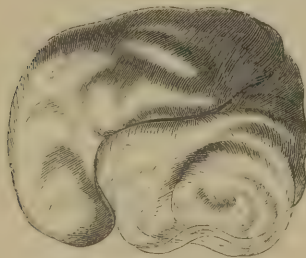


FIG. 14.†



subcutaneous, and probably situated somewhere about the trunk, posteriorly, and solitary. It has the composition and general structure of ordinary fat—*i.e.*, fat-cells (Fig. 14), collected together, and imbedded in a fibrous mesh-work, more or less abundant, and resembling condensed cellular texture; this, however, is continuous with a thin fibro-cellular

\* Fatty tumour, removed from under the tongue; half size. (Liston.)

† Structure of a fibro-fatty tumour. *a.* Isolated cells, showing stellate crystals of margaric acid. (Bennett.)

capsule enclosing the tumour; prolongations of which, penetrating the mass, separate it into lobes, while, externally, the whole investment is loosely connected with surrounding parts. Blood-vessels, collected mostly at one point of the tumour, pass into its substance from the cellular capsule.

*Varieties.*—Occasionally, the cellular capsule is thick, dense, and fibrous. Its prolongations may also become fibrous and firm. The whole substance of such a tumour is hard and comparatively immovable, and although still circumscribed and lobulated, resembles a fibrous tumour. The *lardaceous* variety is of this description. Hard fibrous knots, as of the fibro-cellular stroma, or even bony nodules, can, occasionally, be felt within a tumour, otherwise fatty. Or the mass may be, or become, softer than usual. Oleaginous fat, with but slight fibro-cellular partitions, presents the characters of a bag or cyst of fluid, and gives out the physical signs of a fluid encysted tumour. True cysts are, occasionally, developed in a tumour otherwise fatty; thus giving the consistence of roundish elastic bags of fluid set in a doughy substance. Still more rarely, suppuration occurs, centrally perhaps, within a fatty tumour, and forming a chronic abscess, simulates the character of a cyst.

Lastly, the characters of any such tumour, purely fat or mixed, may be obscured by the depth of integuments beneath which it lies buried.

But all these conditions are exceptional, and, excluding that of the occasional depth of the tumour, they are subsequent conditions also. Neither, therefore, will scarcely affect the exactitude and the earliness of diagnosis, by physical signs; the ordinary physical characters of fatty tumour being generally present, and exclusively indicating this kind of growth and no other morbid condition. *Steatoma*—a lard or suet-like variety of fatty tumour—is liable to occur in whatever part of the body this growth makes its appearance; but steatoma has been found in some parts more especially; among them, in the mesentery, testicle, and mediastinum. (Walshe.)

Fatty tumour is usually a solitary growth; but in exceptional cases, several may co-exist from two or three, up to as many as a hundred, or more.

*Situation.*—Fatty tumour most commonly occurs in the subcutaneous adipose texture, especially of those parts where fat normally abounds in the healthy state, and is liable to accumulate; as about the trunk—*e.g.*, on the back, neck, and shoulder; also over the buttock, and the thigh; between the peritoneum and abdominal walls, escaping from which by the abdominal rings, it forms fatty hernia, so called. (Walshe.)

This kind of tumour occurs more rarely in synovial sacs, especially that of the knee-joint, the "*lipoma arborescens*" of Müller. It sometimes forms where fat is normally scanty, as beneath the hairy scalp; or, where fat is normally absent; as in the sub-mucous cellular tissue of the stomach, the intestine, the bronchi; in the sub-serous cellular tissue of the pleura or dura-mater, and beneath the investing membranes of the ventricles. Also in the substance of organs; especially in the lungs, liver, kidneys, and in bone "affected with osteoporosis and eccentric atrophy." (Rokitansky.) Between the corpora albicantia and optic nerve, in one case. (Müller.)\* A fatty tumour, the size of a mushroom, was found between the arachnoid and dura mater, on the level of the fourth lumbar

\* On Cancer, p. 153.



vertebra. (Albers.)\* One as large as a walnut, in the walls of the vena portæ. (Andral.)†

*Origin.*—Fatty tumour is very rare in children, but not unfrequently begins in youth, though, growing slowly, it may be overlooked for many years; it may begin to grow at any later age, but very seldom appears first in old age. This kind of tumour scarcely ever seems to be hereditary. Sometimes it has so appeared after fever or some general illness, as to seem due to a constitutional cause. It is sometimes referable to local causes, as a blow, or, more commonly, frequent friction, as by a strap or band over the skin. But in the majority of cases, no good cause whatever can be assigned.

*Course.*—The influence of a fatty tumour is purely local and mechanical. The rate of growth is generally very slow, sometimes fitful, very rarely rapid. It does not return, even when partially removed. It is not liable to ulcerate, but I have seen ulceration of the skin, apparently resulting from weight and friction, in the most dependent part of a pendulous fatty tumour in the thigh.

*Treatment.*—Absorption of a fatty tumour is perhaps possible, under the influence of medicinal treatment. Thus, this kind of growth is said to disappear occasionally under the influence of liquor potassæ, administered in half-drachm doses, gradually increased to a drachm, and continued for a month or more. In one case, the tumour was sensibly diminished in size by this mode of treatment, which was originally tried by Sir B. Brodie.

Excision, as a rule, is the only successful treatment. It is rendered necessary by the large size to which a fatty tumour generally attains; and especially when the mass is so placed—which, however, is not generally the case—that by its further enlargement, it would encroach on important parts adjacent, thereby rendering the operation eventually difficult or impracticable. The freedom with which a fatty tumour shifts its place, owing to the loose cellular connexions of its thin dry capsule, is an additional reason for timely performance of the operation. I have thus had occasion to remove a fatty tumour from the cheek, from the shoulder overhanging the axilla, and from other situations. The operation itself, although perhaps extensive, is easily performed.

Dissection, even among parts of anatomical importance, is scarcely requisite. The lobulated mass rolls out of its bed or is easily detached, until some corner appears where the nutrient vessels enter. Hæmorrhage is inconsiderable, but when these vessels are divided, a ligature or two may be needed. Any small portion of the tumour left behind is immaterial, it ceases to grow. The portion of skin to be removed is not so extensive as would at first sight appear necessary. Any small portion spoilt by pressure and any superfluous portion, may be included in the excision; but the remaining integument will retract and pucker up, after the operation.

**FIBRO-CELLULAR TUMOUR.**—This growth is distinguished from polypus, mucous or cutaneous, chiefly by its relation to the adjoining texture. Both are over-growths; but, while polypus is merely an out-growth of fibro-cellular tissue, the same structure, as a tumour, is distinctly isolated by a capsular investment.

*Structural Condition, and Diagnostic Characters.*—The mass, thus

\* Pathologie, B. ii. s. 189.

† Anat. Path. ii. 412.



detached, is roundish, and of tolerably regular outline, usually deeply and largely lobed. Its chief physical character is a remarkably elastic tension, due to the structural resemblance of this tumour to dropsical cellular tissue, circumscribed. It may grow to great size and weight, perhaps forty pounds. Section shows a yellow surface, marked with white lines, which have an undulatory direction across the tumour, and may divide its substance into distinct lobes.

The yellow substance, the white bands, and the capsule, alike consist of fibro-cellular tissue, more condensed in the latter portions; but the whole is remarkably succulent, being infiltrated with a serous fluid, which exudes plentifully and continues to ooze from the cut surface.

*Situation.*—Fibro-cellular tumour occurs most frequently in the scrotum, labium, or tissues by the side of the vagina; or in the deep-seated inter-muscular spaces in the thigh and arm.

As out-growths, some proceed from, and are connected with, the mucous membranes, forming polypi—*e.g.*, in the nasal passages, very rarely in the antrum; in the external auditory meatus; in the uterus, and urinary bladder. (Paget.) As cutaneous out-growths, they appear on the scrotum, prepuce, nymphæ, clitoris and its prepuce. In one instance, a fibro-cellular out-growth—which I examined with the microscope after its removal from the clitoris—was the size and shape of a large cocoa-nut. It weighed thirty ounces.

Fibro-cellular tumour, not out-growth, is usually solitary.

*Origin.*—This kind of growth may begin at any period of life, but most rarely before adult age, and most frequently at middle age or later in life. It is so seldom referable to inheritance, any general disease or to violence, that any such relation would appear to be only a coincidence.

The tissue of which, together with the serous fluid, this tumour consists, represents an immature state of the normal fibro-cellular tissue. With many well-developed filaments, there are more abundant nuclei and cells, forming fibres—fibro-cellular tissue, in various stages of development. Yellow elastic tissue is very rarely present, unlike its frequency in ordinary connective tissue. Analogous, as the texture of this tumour is to ordinary fibro-cellular tissue; it is, nevertheless, of rare occurrence, compared with other tumours—fatty, or cartilaginous—whose component textures, respectively, are reproduced far less frequently than this tissue.

*Course.*—Portions of cartilage sometimes partially ossified, are occasionally produced in, or over, the tumour. (Paget.) Its texture may also degenerate. The rate of growth is variable; being very rapid, as much as three or four pounds a year—*e.g.*, in the scrotum; or more slowly increasing. Recurrence is very improbable, unless the tumour be unusually soft and succulent, and the fibre-cells in great proportion rudimentary.

*Treatment.*—Excision of a fibro-cellular tumour is the only effectual mode of removal. It becomes necessary owing to the increasing size of the growth. The operation cannot be accomplished with the same facility as that of a fatty tumour. Nevertheless, a thin capsule defines the lobulated mass, its connexions are not very close, and the hæmorrhage is but slight compared with the size of the tumour. I have excised such tumours without any recurrence.

The largest fibro-cellular out-growth I have yet seen,—that of the clitoris enlarged to the size of a cocoa-nut, was easily removed by a sweep of the knife through the peduncle.

**PAINFUL SUBCUTANEOUS TUMOUR, or TUBERCLE**—so named by Mr. W. Wood,\* who first described it—is a peculiar variety of fibro-cellular tumour, to which and to fibrous tumour, it is structurally allied; but peculiar, if only as distinguished by the pain, intense and paroxysmal, which commonly occurs, and which is not to be accounted for by the structure of the tumour, itself perhaps destitute of any nerve-filaments, nor by any special relation to adjacent nerves.

This painful tumour, situated in the subcutaneous cellular tissue, is barely visible; for it is beneath the skin, and scarcely projects. It is also of small size, rarely exceeding half an inch in diameter; but it can be readily felt, as a roundish body, very firm and elastic. Isolated by a capsule, this hard body is free in the subcutaneous tissue, and is, therefore, so far moveable; but it may be intimately adherent to the skin, and move with it when pressed under the finger. The superimposed skin, if adherent, has the general appearance of a cicatrix; it is slightly puckered, stretched, glistening and white, unless during a paroxysm of pain, when it may become congested and swollen, and the surrounding blood-vessels turgid.

The surface and section of this tumour are alike in colour variable; commonly yellowish; sometimes only greyish, or pure white. Its substance consists of fibro-cellular or fibrous tissue, with an abundance of nuclei intermixed; and the whole represents an immature state, or rather various immature states, of either tissue. Nerve-filaments have not been discovered. The tumour is usually solitary, as well as subcutaneous. It is thus also distinguished from Neuroma, a fibrous tumour connected with a nerve. This latter species of growth is characterized by the presence of nerve-filaments in, or spread over, the mass; and by the large number of such tumours often produced in various parts of the body, not less perhaps than 2000 having been found in one unprecedented case. (R. W. Smith.)

*Situation.*—Painful subcutaneous tumour or tubercle occurs, as its name denotes, beneath the skin; and especially in the extremities, more particularly the lower limbs, very rarely on the trunk or face. It has, I believe, been found deeply imbedded in the substance of muscle.

This tumour is solitary in nearly every instance.

*Origin.*—Painful tubercle is very rare in both early life and old age. It occurs much more commonly in the female than in the male.

*Course.*—Slow growth, and non-recurrence when removed entirely, characterize the life of this little tumour.

*Treatment.*—This variety of fibro-cellular tumour generally requires the same treatment as that growth. But excision is resorted to, and with the ready concurrence of the patient, to exterminate, so to speak, the otherwise excruciating paroxysmal pain in the tumour, rather than in consequence of any mechanical inconvenience by its size, which is always inconsiderable. The pain may perhaps be relieved, for a time, by firm pressure with a metallic ring placed on the circumferential portion of skin; but the tumour will ultimately have to be excised to obtain permanent relief from suffering. I am not aware that pain ever recurs in the cicatrix, although free excision may be advisable, as a precaution; assuredly the tumour itself never returns, when completely extirpated.

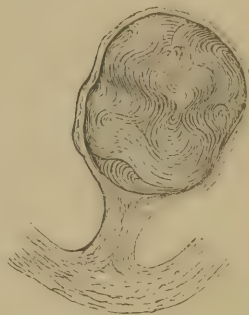
\* Edin. Med. and Surg. Journal, vol. iii., 1812.

*Neuroma* is also amenable only to excision. The nerve-filaments, enclosed in, or expanded over, this little tumour, must generally be divided. Occasionally, the tumour can be dissected out of the nerve, leaving it intact. This more conservative mode of excision is especially important in the case of a large nerve, as the sciatic. But the presence of more than one, sometimes very many, neuromata in various parts of the body, may render any operation useless.

As a palliative, in both these forms of painful tumour, the topical application of the most benumbing anodynes—*e.g.*, the tincture of aconite, is worthy of trial. I have met with instances of fixed pain limited to a spot, at the junction of the ball of the thumb and wrist, and in other situations; where great relief has been obtained by the occasional application of aconitine ointment,—one grain to a drachm of lard. The best aconitine must be used; it was prepared by Messrs. Morson, of Southampton-row, who are justly celebrated for the preparation of this and other vegetable alkaloids.

**FIBROUS TUMOUR.**—*Structural Condition and Diagnostic Characters.*—The great firmness and elasticity of this growth are peculiar; and less so, its spheroidal shape, when uninfluenced by the pressure of surrounding parts, and its occasionally lobulated character. The tumour sometimes attains a large size and weight, even seventy pounds. Its chemical basis is gelatine, but the other constituents are unknown. On section it presents a greyish colour, variously intersected by white opaque lines. It consists of the white, and perhaps the yellow or elastic fibres of ordinary fibrous tissue, which have an undulatory arrangement (fig. 15); and like that tissue, it is but scantily supplied with blood-vessels, which pass into the substance of the tumour from a fibro-cellular capsule, this investment being more apparent around those tumours which are imbedded in solid organs.

FIG. 15.\*



*Situation.*—Fibrous tumours are formed in connexion with the fibrous or fibro-cellular textures; most commonly in the substance of the uterus, or in the fibro-muscular tissue of the ligamentous reflexions of the peritoneum; in the ovaries, Fallopian tubes, or vagina; (Walshe); in the interstitial fibro-cellular tissue of nerves. Connected sometimes with bone, and—like cartilaginous tumours—formed either in its substance, or between it and the peritoneum. The jaws are most liable to this kind of growth. Connected with the dura mater, is another frequent situation. In the sub-mucous cellular tissue, “more particularly of the intestine, stomach, and œsophagus; now and then in that of the larynx;” (Rokitansky); in that of the pharynx, the nares, the frontal and sphenoidal sinuses; in the sub-peritoneal and sub-pleural tissue; (Walshe); in the subcutaneous cellular tissue, as in the lobules of ears, after piercing for ear-rings (Paget); in the mammae, testicle, thyroid gland, thymus gland; in the arterial tissue; and indeed wherever fibrous or fibro-cellular tissue is normally present or most prevalent.

\* Uterine fibrous tumour, section, like polypus, but discontinuous with the substance of the uterus. (Paget.)



Fibrous tumour is usually a solitary growth; excepting in the nerves or uterus, in either of which several may co-exist. But when in the uterus, this species of growth rarely forms in any other part at the same time. (Paget.)

*Origin.*—This tumour has perhaps no definite relation to any period of life, nor to any hereditary constitutional tendency. An apparent exception to this negation, is the uterine fibrous tumour; a fibro-muscular rather than fibrous growth, and which may have some physiological relation to the organ in connexion with which it occurs.

*Course.*—The influence of fibrous tumour is purely local and mechanical. The rate of growth is slow, as compared with that of fibro-cellular tumour; but recurrence is equally improbable.

*Varieties.*—Earthy matter or cysts may be found within the substance of this growth, and hence the terms,—fibro-calcareous and fibro-cystic, as designating these modifications. Other and more important varieties are recurring growths;—the fibro-nucleated (Bennett), and the recurring-fibroid. (Paget.) (a) The *fibro-nucleated* variety presents the external appearance and general characters of an ordinary fibrous tumour, for which it might be readily mistaken. But, the microscopic characters are those of the white fibres of fibrous tissue, mixed with numerous large oval nuclei; thus representing a developmental condition of healthy fibrous tissue. In point of course and tendency, the fibro-nucleated variety does not affect the lymphatics around, nor does it contaminate more distant parts; yet, when extirpated, it has a tendency to return, *in situ*. (b) The *recurring fibroid* variety also, in its first stage, presents the external appearance and general characters of fibrous tumour. But, in its minute structure it consists essentially of fibre-cells, cells elongated and attenuating into white fibres, mixed with nuclei; thus representing another developmental stage of healthy fibrous tissue. Not affecting parts contiguous or remote, the recurring fibroid variety has emphatically, as its name would suggest, a tendency to return, again and again, *in situ*. Moreover, in this its second stage, it successively assumes the appearance of encephaloid cancer; having now become soft, bloody, and fungoid; but retaining its former structural characters, and vital significance, which is only somewhat less than that of encephaloid cancer.

It will, therefore, be observed that the fibrous tumour, and recurring fibroid in its first stage, possess the same physical characters, conjoined with a different structure; and conversely, recurring fibroid tumour, in its first and second stages, presents dissimilar physical characters, associated with the same essential structure.

Yet the vital significance of these growths is of widely different import; ultimately approaching to that of cancer in its typical form.

Growths thus constituted, and endowed, illustrate, even more conspicuously than the fibro-nucleated variety, the diagnostic insufficiency of Physical Signs, [P. p. 224]; and the superior diagnostic value of minute Structural characters, [P. p. 243].

The practical value of this principle of Diagnosis, is to be estimated by the clinical fact, that, in all available situations, the minute structural characters of the tumours in question—and of other doubtful tumours—may be discovered by puncture with a grooved needle and direct examination of the tumour-substance with the microscope.



*Origin.*—Both the recurring varieties of fibrous tumours, usually begin between youth and middle age, very rarely either in childhood or in advanced life.

*TREATMENT. Fibrous tumour.*—Excluding this form of growth in the uterus—excision is still the only known remedy. Considering the large size to which the tumour sometimes attains, and especially, the irregular shape which it acquires by adaptation to the parts around; the operation should be performed early. It is, however, accomplished less readily than that for a fatty, or even a fibro-cellular, tumour. Yet a thin capsule defines, and but loosely attaches the tumour to surrounding parts, from which it can be easily split; and the hæmorrhage is inconsiderable, as pertaining to the tumour. In connexion with bone, the attachment is very close, and the basic portion of bone will probably have to be removed. Enucléation—or simply turning the tumour out of its bed—is available in some instances; chiefly for the removal of uterine fibrous tumours. Recurrence, after either mode of operation is very improbable.

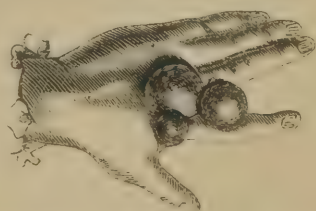
*Recurring Fibroid, and Fibro-nucleated Tumours.*—The treatment of both these recurring varieties of fibrous tumour is governed by the same general considerations. They are not influenced by any known medicinal agents, except perhaps the first named variety of this growth. Iodide of potassium in large doses continued for several weeks, seems to have prevented the return of recurring fibroid tumour, in cases observed by Dr. Esmarch of Kiel. Excision is the only other resource. The size and often rapid growth of these tumours, are urgent considerations. The operation must be freely performed, to ensure, if possible, total extirpation of the tumour, which, however, is localized, though apt to return. Hæmorrhage may be profuse.

The probability of recurrence is uncertain. Any such tumour may be removed, apparently entirely, an indefinite number of times, and each interval may be of longer duration, even to some years apart, after repeated operations; thus prolonging life, and granting successive periods of ease. Or, as is usually the case, this history may be reversed; more rapid growth, and shorter intervals of freedom, larger operations, progressive exhaustion and death.

*CARTILAGINOUS TUMOUR.—ENCHONDROMA OF MÜLLER.*—*Structural condition and Diagnostic characters.*—This tumour presents the appearance, the chemical composition, and the structure of masses of fœtal cartilage. It is enclosed in a tough fibrous capsule, which conducts a few blood-vessels.

The surface of a cartilaginous tumour is more or less irregular and lobulated, the fibrous capsule passing in between and separating the lobes; the whole mass varying also considerably in size (Figs. 16, 17). Its substance is pulpy or more consistent, it may be hard, but elastic, crisp when cut, and a section is bluish-white, like London milk, glistening

FIG. 16.\*



\* Enchondroma of the hand. (Druitt.) The tumours are drawn too regularly round, and have not the nodulated character of the cartilaginous tumour. (F. J. G.)

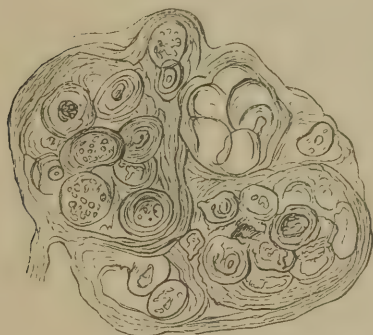
and translucent. These appearances, however, vary with modifications of structure.

FIG. 17.



Two structural elements are found, the same as in ordinary cartilage; cells, and an inter-cellular substance, the latter being semi-transparent or molecular and dim,

FIG. 18.\*



but more commonly fibrous. (Fig. 18.) The cells also may be scattered or aggregated, multiform, and they resemble either mature or rudimentary cartilage-cells. Their envelope is, therefore, more or less defined, it encloses one or more nuclei, within each of which is seen a nucleolus or two. Occasionally, the nucleus appears radiated, not unlike the lacunæ and surrounding canaliculi of bone. There is, in fact, an intimate structural homology between the cartilaginous tumour and healthy cartilage, in its develop-

mental conditions; and this resemblance extends to the myeloid variety of enchondroma.

*Situation.*—Cartilaginous tumour is most frequently connected with the bones and joints; especially those of the hand—*i.e.*, phalanges and metacarpus, the corresponding bones of the foot, particularly the last phalanx of the great toe; the lower end of the femur, neighbouring end of the tibia; the humerus, sternum, ribs, ilium, and cranium. Apart from bone and cartilage, these growths may form in the parotid gland, testicle, mammary gland, lungs, and in the subcutaneous areolar tissue. (Rokitansky.)

\* Cells, and inter-cellular substance or stroma, of a cartilaginous tumour, from the phalanx of a finger. Many of the cells are only drawn in outline; some of them present double or triple contour lines; most of the nuclei are large and granular. The groups of cells are intersected by bands of tough fibrous tissue. Magnified about 400 times. (Paget.)

This kind of growth is not unfrequently solitary, excepting in connexion with the bones of the hands or feet, where several may co-exist.

*Origin.*—In connexion with bone, cartilaginous tumour begins most commonly at an early period of life; some, on the hands, in infancy, others, more often, between childhood and puberty. Their beginning in later life is, however, not very rare, even on the bones: and in other parts, they commence, usually, in full adult or middle age. Inheritance, or injury, may have some influence in the production of this tumour, particularly in connexion with bone.

*Course.*—The influence of a cartilaginous tumour is purely local and mechanical. The rate of growth is uncertain; generally slow, occasionally rapid. Recurrence is very improbable, unless in the case of a soft cartilaginous tumour.

*Varieties.*—The consistence of an ordinary cartilaginous tumour is liable to undergo remarkable changes. A species of ossification sometimes takes place, beginning either on the surface or within the substance of the tumour. Again, the whole tumour may soften and feel like a fatty growth, or a mass of colloid cancer; or ossific nodules may soften and feel like a group of cysts. Such are the most important points of apparent resemblance between the cartilaginous tumour and other growths.

*Myeloid tumour* is allied to the fibrous by virtue of one structural element, the fibre-cell, and to the ordinary cartilaginous tumour by its more abundant many-nucleated corpuscles. These corpuscles and imperfect fibres appear to be identical with those of healthy rudimentary bone. Hence, the marrow-like “myeloid” in substance, as so designated by Paget, has also been named “fibro-plastic” tumour, by Lebert, its structural elements resembling those of granulations springing from healthy bone.

The external characters of the myeloid variety of cartilaginous tumour are tolerably definite. Its surface is more or less lobulated. If enclosed within bone, its shape is uniform and spheroidal if seated on the surface of a bone, its outline is irregular, as seen in epulis. The fleshy, inelastic firmness of a myeloid growth is remarkable, although its consistence varies. On section, the surface presents a greyish-white basis colour, daubed with irregular blotches of a bright red, livid or brownish tint. This blotched appearance is unconnected with any corresponding vascularity, the supply of blood-vessels being scanty even when the tumour is most ruddy. The cut surface is also succulent, and exudes a yellowish fluid.

*Situation.*—Myeloid tumour selects bone more frequently than any other tissue. Paget has seen this growth in the mammary gland, and probably also in the neck near the thyroid gland.

*Origin.*—The tumour begins very rarely in early life, or in old age; most frequently between youth and middle age. It is seldom referable to inheritance, defective health, or injury.

*Course.*—The rate of growth is usually slow. Myeloid tumour is not apt to ulcerate or protrude like a recurrent fibroid growth; but it is liable, if not prone, to return when extirpated by the knife, thus differing essentially in its vital career from the typical form of cartilaginous tumour.

*TREATMENT.*—Cartilaginous tumour must be removed by surgical operation. But, the size to which it may grow is scarcely so much a considera-



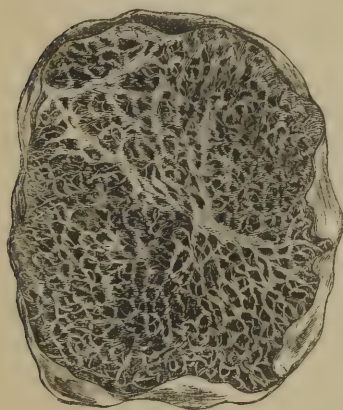
tion, as the firm attachment of the tumour to bone, in the great majority of cases. Amputation, therefore, rather than excision is indicated. The performance of the latter operation is aided by certain circumstances. The mass, usually lobulated, is defined by a tough capsule investing the whole surface, excepting at the base of attachment. Within bone, this investment is complete. In either case, the capsule is connected to the texture around, by a dry connective tissue which can be more or less readily split up. The hæmorrhage is but slight, as occasioned by removal of the tumour itself only sparingly vascular; and the surrounding textures are singularly healthy.

Enucleation of a cartilaginous tumour from within bone, is—observes Mr. Paget—more often practicable than practised.

Recurrence need not be apprehended, otherwise than in exceptional cases.

*Myeloid tumour* admits only of free excision or amputation, and as a recurring growth is far less favourable for operation.

FIG. 19.\*



#### VASCULAR OR ERECTILE TUMOUR.—

*Structural Condition, and Diagnostic Characters.*—This tumour essentially consists of a conglomeration of blood-vessels, connected together, more or less intimately, by fibro-cellular or connective tissue, which may form an investing capsule; the whole being thus circumscribed as a distinct tumour, but of irregular shape, and perhaps lobed (Fig. 19); or, the mass not being distinctly isolated, is diffused, flattened, and shades off into the surrounding textures. The size or extent of such a mass, in either case, varies with its growth, and is subject to temporary alterations, under circumstances which will be noticed presently.

*Situation.*—This species of tumour may be deep-seated, in or among muscles, in bone, the stomach, spleen, liver, the orbit, the tongue, and indeed wherever capillary blood-vessels naturally exist and most abound. The diffused form is more frequently situated superficially, as beneath the skin, and probably involving it; constituting the common cutaneous nævus, as seen on the scalp or the face.

*Varieties.*—Three varieties of this tumour are well defined, and easily recognised when it is patent. The constituent blood-vessels are capillaries, with arterial and venous trunks proceeding respectively, to and from the mass; but either order of vessels may predominate, and constitute nearly the whole mass, apart from the connective tissue. Thus then there are the capillary, the venous, and the arterial varieties of vascular tumour.

The *first* consists almost entirely of capillaries—large, dilated, and convoluted. The *second*, almost entirely of veins or venous sinuses—

\* Section of an erectile-tumour—showing the fibrous trabecular structure, and investing capsule.—Museum of the Royal College of Surgeons, England. Drawn one-third larger than the specimen.



forming a cavernous and erectile structure. This variety of vascular tumour, was that which John Bell specially described,\* and to which he gave the name of "aneurism by anastomosis," or "Aneurism by the dilatation of anastomosing vessels.† He compared it to the erectile structure of the penis, the gills of a turkey-cock, or the substance of the spleen, placenta, or womb. The *third* variety consists almost entirely of arteries—large, tortuous, and perhaps convoluted. This is now called—"aneurism by anastomosis." (Fig. 20.) These varieties of structural condition are accompanied with corresponding peculiarities of *physical* characters, by which their diagnosis during life can be determined.

FIG. 20.



The vascular tumour is soft and compressible, but regains its former size when the congeries of vessels is left free to fill again. Its substance somewhat resembles a sponge; and if visible, as when subcutaneous or in the skin, the colour of this distended sponge plainly shows that it is full of *blood*, arterial or venous. The capillary and venous varieties are alike characterized by their circumscribed shape and soft doughy consistence, which can be moulded under the fingers; but at the same time a trembling sensation or *indistinct throbbing* is felt, if the mass for the most part be venous, and have attained some size. After compression, the tumour *slowly re-distends*, and assumes increasing size and tension during exertion, especially if sudden and violent, as running, coughing, straining, struggling; and by any obstruction to the free return of venous blood. A *bluish* tint is perceptible when the tumour is situated superficially. Lastly, if wounded, the mass collapses. The arterial variety is chiefly distinguished by its *strong* pulsations, and threatening distension, increasing

\* Principles of Surgery. Ed. by C. Bell, 1825, vol. iii. p. 328. † Ibid., p. 386.

also under any occasional excitement of the heart's action, and with the flow of arterial blood.

*Origin.*—The vascular tumour is not unfrequently a congenital growth; it may be a subsequent formation, but more frequently in childhood than in after years. The progress of growth is not generally steady, but by fits and starts; sometimes rapid, sometimes slow-growing. Very commonly—observes Paget—their increase is only proportionate to that of the rest of the body; and when full growth is attained, they also cease to grow. Not rarely they are stationary, or shrink, even while the rest of the body is growing; and this is especially likely to happen with those that are white and scar-like where the skin is involved.\*

*Course.*—The same authority also notices certain structural alterations to which the vascular tumour is subject, by degeneration or by disease.

These morbid conditions disguise the original character of the tumour, and may now mislead the diagnosis. Thus, a vascular tumour may become converted “into a soft, but tough and dry yellow-ochre or brown substance, like that of a supra-renal capsule.” Scar-like patches is another transformation, affecting the substance, or surface of the tumour, and accompanied with closure of the vessels in that portion. Acute inflammation may consolidate and cure; or, leading to ulceration, form bleeding sores, ill-disposed to heal. Either blood-clots, or phleboliths, sometimes partially consolidate; or cysts, serous or sanguineous give a more elastic feel to the mass. More rarely, this kind of growth, forms in another growth, and usurping its structure, converts part, or the whole of such growth into a vascular tumour, and acquires its character. Lastly, “it is probable also that one form of vascular tumour may be converted into another: a capillary one becoming either arterial or venous, by the excessive growth of one or other set of vessels; or an arterial one, by opposite changes, becoming either capillary or venous.”

*Treatment.*—Vascular or Erectile tumours admit of treatment in accordance with each of the three general indications pertaining to morbid growths.

(1.) Absorption, by compression, steadily maintained by means of the air-cushion and spring. Compression is most practicable and effectual when the tumour rests on bone, thus supplying counter-pressure.

(2.) Obliteration, by cauterization, or injections, for the purpose of producing sloughing or consolidation of the tumour. Either plan of treatment is most appropriate for small vascular tumours, as certain nævi. In parts where the deformity occasioned by sloughing and cicatrization are unimportant considerations; cauterization, with the strong nitric acid freely applied to the integument covering the tumour is perhaps warrantable. In parts otherwise circumstanced, as the face, the injection of some stimulant into the tumour is preferable, with the view of exciting inflammation short of sloughing, and thence consolidation of the tumour. Perchloride of iron may thus prove remedial, introduced drop by drop at different points, by means of a glass syringe, having a screw piston and a fine penetrating nozzle. Setons of silk, passed through various parts of the tumour, and allowed to remain in for some days, will, perhaps, more slowly produce the same result.

I have not had much experience in either of these, or similar modes

\* A System of Surgery, 1860. Ed. by T. Holmes, vol. i., Tumours.

of treatment. What I have done or seen has led me to avoid such applications, as useless or perilous.

(3.) Removal, by ligature or excision. The former method is appropriate for vascular tumours *larger*, and, therefore, more arterial or venous, than those which can be safely obliterated by caustics or injections, or in cases where such treatment has failed. The advantages are; less liability to hæmorrhage, and a more healthy sore when the tumour is detached. The difficulties are; to include all the vessels connected with the tumour around its base, and to completely strangle without cutting them by the ligature,—thus ensuring extirpation of the growth. But success is at least equally uncertain with regard to the treatment both by obliteration and absorption. Cessation of pulsation, a thrilling tremor in the tumour, and inability to reduce it by pressure; are signs that the operation of ligature has been effectually performed.

An erectile tumour requires, and is amenable to operative treatment, according to its size, situation, and the character of the growth.

NÆVUS.—When of small size, cutaneous, and not progressively increasing, a nævus may well be left to itself; and it may atrophy, wither, and disappear. When of large extent, although superficial, as occasionally seen on the face, presenting the appearance of a large purple patch; such nævus must be left alone, it is irremovable, albeit a great disfigurement. But, when nævus is of large size, or subcutaneous, and increasing in size, occasioning also much disfigurement; operative interference becomes necessary, and indeed urgent in proportion to the development of these characters.

*Operations for the cure of nævi* may be performed with a view either to their destruction and obliteration, or to their removal. (1) To induce adhesive inflammation in the substance of the tumour, with coagulation and permanent plugging of the erectile tissue; (2) cauterization, by the application of strong nitric acid or potassa fusa, in order to thus destroy the growth; (3) removal by excision, with the knife; or (4) by ligature, applied subcutaneously. *Adhesive inflammation*, as a means of destroying nævus, is eligible only when the tumour is of small size, and occurs in situations inaccessible for excision or ligature. Nævi situated near the eyelids, at the inner canthus, or on the tip of the nose, are thus circumstanced. Inflammatory adhesion and coagulation may be induced in various ways. By the injection of some stimulant, as perchloride of iron, by means of a screw-piston glass syringe, as used for the hypodermic injection of morphia; care being taken to throw in not more than two or three drops at one time, lest sloughing supervene, or coagulation extending into the surrounding vessels, a fatal embolism ensue from a clot entering the general circulation. Galvano-puncture is another mode of exciting coagulation, and consolidation. Subcutaneous puncture, and division of the vascular tissue, by means of a fine tenotomy knife, is also an efficient, and a safe mode of destroying the tumour, in like manner. Or, by the introduction of seton-threads, for a sufficient time, and at different parts, so as to induce inflammatory consolidation.

*Cauterization*, is eligible for the destruction of nævus, where it is small, and cutaneous; and its disfigurement is worse than the cicatricial scar resulting from the application of strong nitric acid or potassa fusa. Thus, a small "mother's mark," or an acquired vascular spot, may be touched with a glass rod dipped in the acid, or lightly pointed with a stick of the caustic.

*Excision* may be resorted to for the removal of large nævus, but this method will be appropriate especially when the growth is distinctly encapsuled, and can be dissected or shelled out.

*Ligature*, applied subcutaneously, is the other method of removal which must be had recourse to, in all other conditions of nævus, when of large size, not encapsuled, but connected with large feeding blood-vessels, especially arterial. The hæmorrhage attendant on excision would be dangerous or fatal, and can only be prevented or controlled by ligature.

Accordingly, the objects to be accomplished are; the complete and immediate strangulation of the vascular tissue, observing to include the whole tumour, and well around the limits of the disease; but avoiding the skin, which may either be divided in the intervals of the ligatures, or a single ligature be passed subcutaneously. Small, firm, round whip-cord answers best. The nævus needles are curved, and firmly set in wooden handles, resembling aneurism-needles.

Nævus, of moderate size, and in a situation where cicatricial disfigurement is not of much consequence, may be ligatured by two double ligatures passed underneath the base of the tumour, and crossing in opposite diameters, so as to divide it into four sections; the skin may be either reflected, or divided circumferentially, in the intervals of the

FIG. 21.



ligatures, which are then successively drawn sufficiently tight around the base of tumour, and tied in a reef-knot. An ordinary nævus on a child's head, generally thus admits of ligature. (Fig. 21.) The tumour, when effectually strangled, sloughs in a few days, leaving an open sore, which granulates and cicatrizes.

Nævus of larger size, and so placed that the sacrifice of integument



would entail much disfigurement, may admit of subcutaneous ligature; the skin being left entire in this operative procedure, and consequently not sacrificed by sloughing. The *nævus*-needle, armed with a double ligature, is introduced at some point of the base of the tumour, and carried round its circumference to the same point; the cord is drawn out into a single ligature, the needle withdrawn, and the two ends pulled steadily and tied tight enough to thoroughly strangle the included mass of vascular tissue. If the mass be so large, or so placed, that it cannot be thus encompassed by a single passage of the ligature, then, the needle-point may be made to emerge at a convenient spot, one end of the cord drawn out, the needle withdrawn, and having been re-threaded with that end of the ligature, it is re-introduced at the point of emergence and carried round the remainder of the tumour to the point, where it was first introduced; the operation being completed by strangulation and securing the ligature. A *nævus* on the cheek can be removed by this method, without any resulting disfigurement, more than a puckered appearance. I have known a dragging down of the lower eyelid to ensue, but this can be remedied by the operation for Ectropium. Ligature may be employed at an early period of life; in infants a month or two old, and with a successful result.

ANEURISM BY ANASTOMOSIS, consists of large freely communicating blood-vessels, principally arterial; and the tumour must be removed by ligature, either of the circumferential feeding branches, or of the main trunk of the part.

The former procedure has not been followed by successful results; ten recorded cases having failed, without one single instance of ultimate cure. In two cases, however, where the scalp was the seat of aneurism by anastomosis, Gibson aided the effect of circumferential ligatures by incisions around the tumour in the intervening spaces; and this procedure proved successful.

Ligature of the main trunk has been practised on the carotid, when the tumour was seated on the scalp, or in the orbit; or the brachial, and femoral arteries, have been ligatured, when the disease occurred on the arm or leg. The carotid has been tied in twenty-three recorded cases; in five of which, both arteries were tied at intervals of several weeks. Single ligature proved successful in some of the cases; double ligature in all five. Ligature of the carotid for aneurism by anastomosis in the orbit, has been performed in thirteen cases; with a successful result in the majority.

These two procedures,—ligature of the circumferential arteries, and of the main trunk, may be combined or practised in succession, and the former aided by the intervening incisions.

Excision is also applicable to the larger sized vascular tumours; especially those of a venous character, and those which are encysted. But the situations should be such as to allow of the parts being readily brought together, after the operation. Free excision, moreover, is necessary to prevent the risk of hæmorrhage subsequently, and compression of the coapted parts will be an additional precaution.

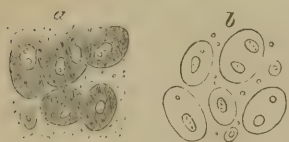
OSSEOUS and GLANDULAR TUMOURS, respectively, are more properly considered in connexion with Diseases of the Bones, and Glandular Organs.

INFILTRATING GROWTHS comprise, perhaps, only one genus—*Cancer*: its typical species being Encephaloid, Scirrhus, and, perhaps, Colloid, with

many sub-varieties; distinguished chiefly by shades of difference in their general characters of colour, consistence, shape, size, and mobility.

*Structural Condition, and Diagnostic Characters.*—The three species of cancer present under the microscope the same cell. (Fig. 22.) This, at

FIG. 22.\*



first colourless and pellucid, consists of a delicate envelope, containing a large clear nucleus or two, sometimes more, never less—within each of which is imbedded one or two nucleoli, also large and clear. Such is the “cancer cell.” (Bennett). But is this cell peculiar to, and characteristic of cancer? In considering the diagnosis of cancer, I

shall have occasion to recur to this question.

FIG. 23.†



The cell assumes various shapes; either round, more usually caudate or spindle-shaped; and presents other forms by outgrowths in one or more directions. These cells are deposited in a filamentous stroma or meshwork, which has a variable locular arrangement and closeness of texture. (Fig. 23.) This inter-cellular stroma is probably, in most cases, nothing more than the fibrous tissue of the textures, amid which the cancer-cells are infiltrated. But another inter-cellular substance—gelatinous, translucent, and amber-coloured, may be present in more or less abundance, and this is probably peculiar to cancer,—the colloid species.

The leading species of cancer are further allied by possessing a similar chemical basis: namely, chiefly albumen, associated with fibrine, gelatin, osmazome, fat, certain salts,—such as the phosphates and carbonates of lime, with the carbonates of soda and magnesia, the oxide of iron, and water. But the results of chemical analysis hitherto made are not very reliable.

*Species.*—As the proportion of cells, or of inter-cellular matter, prevails, so do we recognise *Encephaloid*, or cancer, *par excellence*, abounding with cells; and, therefore *soft*, opaque, and of a dead white or fawn colour. Hence the terms *cerebriform* or *medullary*, applied to this form of the disease; and—the cellular or special element of cancer, predominating—encephaloid yields on pressure an abundant quantity of “cancer-juice,” which resembles milk or cream. *Scirrhus*, on the other hand, is far more *fibrous*, and, therefore, *hard* and *craggy*; semi-transparent in a thin section, and of a bluish-white or fawn colour; comparatively little “cancer-juice” is exuded on pressing the cut surface of the fibrous stroma, and this little rather resembles thick gruel than cream, or it may be a small quantity of thin yellow serous fluid exudes; but the fibrous stroma itself contracts, whereby the cut surface speedily assumes a concave aspect, unlike the section of any other tumour, which remains level or becomes slightly convex at its margins.

*Colloid*—in contrast with both the foregoing—is *gelatinous*, owing to

\* Cancer-cells *a*, from scirrhus of the mamma. Transparent cells *b*, seen after the action of acetic acid. 250 diam. (Bennett.)

† Section showing the arrangement of cells and fibrous stroma in scirrhus of the mamma. (Bennett.)

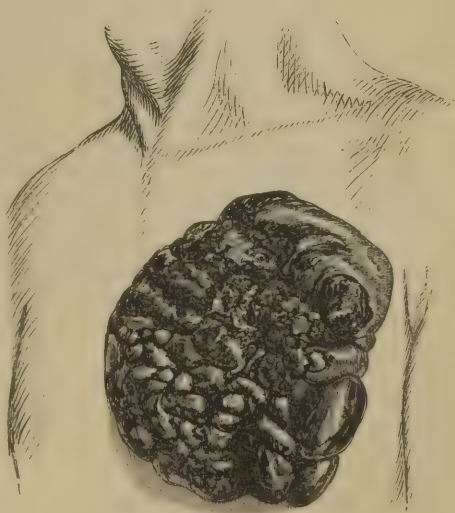
the predominance of the gelatinous, intercellular matter, and in which the cells are suspended; the whole being infiltrated through a delicate fibrous stroma: it appears, therefore, either as a trembling mass, or a glairy fluid—dimly transparent, and of a greenish yellow colour.

Cancer is essentially an *infiltrating* growth; but while this peculiarity almost constantly prevails in scirrhus and colloid cancers, encephaloid becomes *encysted*, about as frequently as it remains free. A very thin, yet distinct fibro-cellular capsule may invest this typical form of cancer, and from which thin partitions pass into the tumour thus defined, intersecting its substance, or investing its several lobes. Generally speaking, this capsule is not adherent to the surrounding textures; it furnishes a *matrix* in which numerous and tortuous blood-vessels ramify, previous to supplying the mass itself with vessels. Encephaloid is, indeed, always abundantly vascular, as compared with scirrhus and colloid, both of which are relatively destitute of blood-vessels. Nerves probably exist in the substance of a cancerous tumour; for pain is felt in scirrhus, and less so in encephaloid cancer, when cut into during a surgical operation. But the question of nerve supply, in point of proportion and distribution, has yet to be demonstrated anatomically, by dissection.

*Tumour.*—The investing capsule, when present, gives a definite outline to an encephaloid tumour—round, oval, spheroidal, or lobed, which contrasts with the irregular and unbounded outline of scirrhus and colloid, the infiltrating course of which is very rarely circumscribed. The boundary of either of these species of cancer is perceived rather by their degrees of consistence as compared with that of the textures around the seat of infiltration.

The greater vascularity of encephaloid, coupled with its *capsular* and therefore more isolated condition, in many cases, are circumstances favourable to a corresponding rapidity of growth, and evolution as a distinct tumour; consequently this, the typical species of cancer, frequently attains an enormous size and protrudes (Fig. 24): but scirrhus being differently circumstanced in these respects remains smaller, rarely acquiring a larger size than an orange, and this rendered indistinct by infiltration of the surrounding textures. It shrinks yet smaller by their condensation and absorption, as its abundant fibrous stroma,

FIG. 24.\*

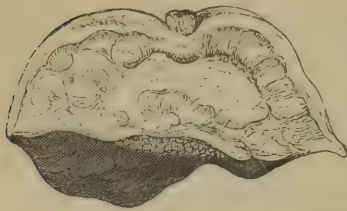


\* Advanced carcinoma of the mamma,—exhibiting a prominent, fungoid, and bleeding mass. (Cruveilhier.)



continuous with parts around, draws texture after texture within the claws, as it were, of the infiltrating mass. (Fig. 25.) Infiltration

FIG. 25.\*



penetrates onwards, while contraction pulls backward; so that there is a double action at work—like the pulling on of a glove. Colloid cancer, although ill provided with blood-vessels for rapid growth, is scarcely restrained by a contracting fibrous stroma, and—in this particular resembling encephaloid—it spreads to an indefinite size, but not as a distinct tumour.

The circumscribed, or non-circumscribed, condition of cancer, much affects its mobility as a distinct tumour. Encephaloid is often distinctly moveable in the organ or textures in which it is embedded; while scirrhus and colloid can be moved about, only as a diffused mass in connexion with those textures to which the cancer has contracted adhesion by infiltration.

Such are the chief peculiarities respecting the shape, size, and mobility of the three typical species of cancer—in addition to their individual properties of consistence (and colour); and by the concurrence of which characters they can be readily recognised during life.

*Diagnosis.*—No sufficiently exact structural differences have as yet been detected, by which to distinguish these species of cancer-growth; we are, therefore, compelled at present to rely solely on their physical characters to determine the question of their (*differential*) diagnosis, so far as these characters can be recognised through superimposed integuments.

This conclusion refers only to the *comparative* value of structural characters; for many other circumstances associated with cancer—its seat, character of the pain, course, and duration, its influence on surrounding parts, the constitutional symptom of cachexia, and the peculiarities of age, sex, previous diseases of the individual, and hereditary taint—combine to regulate the diagnosis.

But the structural *individuality* of cancer-growth, as a distinct species of growth, is itself uncertain. The supposed characteristic “cancer-cell,” is occasionally absent in tumours, otherwise cancerous; and similar cells may be found, and as often—according to Forster—in healthy as in diseased tissues, and are, therefore, not peculiar to cancer. These two propositions, taken together, *apparently negative* the value of the “cancer-cell,” as the most exact ground of identification.

If, however, structural characters only, are reliable for the exact diagnosis of certain growths—*e.g.*, fibrous tumour, and its recurring fibroid and fibro-nucleated varieties; while in respect to other species of growth—*e.g.*, cancer, the structural individuality of the cancer-cell is equivocal; then, the identification of the latter growth—by virtue of its structural characters—turns upon the question, can the variable conditions of this cell be explained?

In tracing the Law of Structural Retrogression, with regard to the interpretation of the minute structural constitution of growths and other morbid products of nutrition (P. p. 93), it will be seen that the structural element of cancer,—the “cancer-cell,” corresponds to the cartilage-cell,

\* Scirrhus of Breast.—Section showing retraction of nipple.



or to certain epidermic cells,—in various rudimentary stages of their development. Thus may, perhaps, be explained the not unfrequent association of cancer-cells with the healthy tissues whose structural elements are analogous or identical. Excluding, therefore, those *exceptional* forms of growth which simulate cancer in their clinical history, but which do not present the cells of cancer; and excluding also those *exceptionally* healthy tissues with which similar cells are found; this structural element is the most unequivocal sign of the presence of cancer. In like manner, the different species—encephaloid, scirrhus, and colloid—so far as they can be distinguished by structural characters—represent rudimentary stages of analogous cartilage-cells. With reference to the structural individuality of cancer, as a distinct species of growth, and its three leading species or varieties—the value of structural characters is thus fully confirmed, as the earliest and most exact ground of diagnosis.

In not a few cases, I have thus clearly demonstrated the nature of a cancer-tumour; by puncture with a grooved needle and submitting the material withdrawn to microscopic examination.

The three species—encephaloid, scirrhus, and colloid—may possibly coexist and be combined in the same growth. Of this association I once saw a remarkable example in the *post mortem* examination of a patient, who had been under the care of one of my colleagues at the Royal Free Hospital. The abdominal viscera were literally agglomerated into an enormous mass of cancer, which consisted of the three cardinal species above mentioned. A beautiful wax model is preserved in the museum of the hospital. Then, again, these species of cancer may succeed each other, as well as coexist, in the same individual. Yet, with all this fraternization, they never lose their individuality; they never become transformed. On the contrary, each species preserves its own general characters, and this too, through many subordinate varieties. These varieties, like the typical forms themselves, are, in most instances, occasioned by different proportionate quantities of their constituent elements—the cancer-cells and fibrous stroma. Some of them, however, are occasioned by morbid changes of structure; degeneration, and the consequences of inflammation.

*Varieties.*—Many varieties of cancer have been described; of which some are worthy of notice, not because they possess any essential importance, but owing to the characteristic appearances they present. The most important varieties are the following:—They are distinguished and recognised by their physical characters, which have suggested appropriate names. The varieties of *Encephaloid* are,—“mastoid” cancer, so named from its resembling, on section, the boiled udder of the cow. This term was originally proposed by Abernethy. “Solanoïd” cancer resembles, on section, a sliced raw potato. It is hard, almost homogeneous, pale yellow, and crisp; hence this name, which was first suggested by Recamier. The substance of such a mass yields milk-like fluid in abundance, under pressure, and eventually softens. The “milt-like” tumour, so named from its general resemblance to the milt of certain fishes. (Monro Tertius.) “Nephroid” cancer exhibits, on section, a peculiar arrangement of the fibrous stroma, and a semi-transparent watery glossiness, with other characters, not unlike those which the section of a kidney presents; whence its name. (Recamier.) “Fasciculate” cancer is another variety suggested by the peculiar appearance of its fibrous structure. (Müller.) The coexistence of softness, and linear or fibrillar arrangement, constitutes its most readily ascertainable peculiarity.

(Walshe). "Hæmatoid" cancer is a variety of encephaloid, in which the brain-like character is associated with an unusual amount of vascularity, the vessels sometimes interlacing so as to constitute a dense and somewhat spongy network, without, however, the peculiar structure of erectile tissue. "Fungus hæmatodes" is rather an advanced stage of encephaloid, than a variety of this species of cancer. It represents the occurrence of interstitial hæmorrhage, which either infiltrates the whole mass, or forms irregular accumulations of blood in its substance; and ulceration of the integuments taking place, a fungoid bleeding growth protrudes. "Villous" cancer is a term somewhat expressing the appearance presented by this variety of encephaloid. It is very vascular, and apt to bleed copiously. This and its other characters are well marked when the disease occurs on the mucous membrane of the urinary bladder. It is described by Rokitsky as "dendritic vegetation;" an excrescence consisting, in its stem, of a fibroid membranous structure, on which the branches and villous flocculi are borne, as larger and smaller pouch-like and flask-shaped buddings, or sproutings of a structureless hollow tissue. "Melanotic," or melanoid cancer, is, with very rare exceptions, medullary cancer modified by the presence of black pigment in its elemental structures. (Paget.) This is a species of degeneration, besides which, encephaloid is subject to fatty and calcareous degenerations. Other morbid changes are suppuration and sloughing, which it is very liable to undergo.

The varieties of *Scirrhus* are:—So-called "Chondroid" cancer, which is an early stage of scirrhus, dense and crisp; exhibiting, on section, an unusually shining aspect, and bluish-white colour. (Recamier.) "Lardaceous" cancer is occasioned by the infiltration of scirrhus through the substance of an organ, which then frequently appears not unlike the boiled rind of bacon. "Napiform" cancer is so named from the peculiar arrangement of its fibrous stroma, which, on section, has some similarity to a cut turnip. (Recamier.) "Apinoid" cancer derives its name from the striking resemblance presented, on section, to the cut surface of an unripe pear. This similitude arises from the dissemination of comparatively opaque and almost buff-coloured spots through a translucent ground of very pale yellowish-lilac tint. The quantity of more opaque substance gradually increases, and eventually predominates, so as to alter the appearance of the surface completely. (Walshe.) Allied, is the "reticular" cancer of Müller. "Hæmatoid" scirrhus is a condition of rare occurrence; but when it does happen, its peculiarities are of the same kind as those of the hæmatoid variety of encephaloid; differing, only in being less fully developed. (Walshe.) "Osteoid" cancer, or ossifying fungus growth (Müller), occurs as a tumour, consisting chiefly of bone, but having on its surface, and in the interstices of its osseous parts, an unossified fibrous constituent, as firm as fibrous cartilage; after a time, similar growths ensue in parts distant from the seat of the first-formed, and not on bones alone, but also in the cellular tissue, serous membranes, the lungs, lymphatics, etc. It would appear to be the calcareous or osseous degeneration of scirrhus, or of medullary cancer, with which it not unfrequently coexists. Uninterrupted gradations may be traced between the osteoid variety and these typical forms of cancer. (Paget.) Scirrhus is subject to other species of degeneration, and to morbid changes in common with encephaloid. Ulceration is more frequently observed in the course of scirrhus.

*Colloid* cancer is singularly exceptional in not presenting varieties, properly so called. Nevertheless, the quantity of fibrous stroma, or of colloid matter, may respectively predominate. If the former, then this species assumes the appearance of a very tough, white, fascia-like mass, in which are small separate cysts or cavities, filled with the colloid substance. In the opposite extreme, large masses of colloid matter appear to be only intersected by fibrous white cords or thin membranes, arranged as in areolar tissue, or in a wide meshed network. (Paget.) Another variety refers to the *quality* of the colloid matter, rather than its quantity. It may be, or become, white and pearly, or opaque. I once met with a remarkable specimen of colloid cancer, in a female patient at the Royal Free Hospital (1862), and which I carefully examined. Most of the abdominal and pelvic viscera were affected with this disease;—namely, the stomach; the intestinal canal, which was beset externally, here and there, with pedunculated masses of colloid, somewhat resembling plums on their stalks; two colloid masses were imbedded in the spleen; the pancreas was wholly converted into the same gelatinous substance, enclosed in loculi; the bladder was distended with a trembling mass, which rolled out like a jelly, leaving the mucous membrane pulpy, ragged, and bloody. The substance of the uterus and ovaries was infiltrated with drops of colloid, together forming a mass which seemed to be incorporated with a similar condition of the rectum. The gelatinous matter thus extensively diffused, was in some parts white, and of brilliant pearly transparency, looking like colourless and clarified jelly throughout the pancreas; white and opaque in the spleen and uterus; while it presented its usual amber colour and transparency in the other organs I have specified. This *opacity* of the colloid matter was probably due to molecular disintegration.

Such are the principal varieties of each of the three typical species of cancer. Some of them are, as I have said, the result of certain *morbid* changes, to which cancer itself is liable; they are illustrations of a pathological law which prevails extensively—that morbid products themselves undergo morbid changes—the diseases of diseases. Hence their almost numberless, and sometimes perplexing, complications.

**CYST-FORMATION.**—A further illustration of this law, I have yet to notice in relation to cancer. This relation, if not one of accidental association, represents an actual substitution of cyst-formation for cancer-growth, and at the expense of its own structural elements. Thus cysts may either be formed with cancer; or from and out of the cancer-structure, by their erring development and growth.

Mr. Paget's work contains the best summary of this subject, of which the following is an abstract.

(1) Respecting cysts accidentally associated with cancer, but of *independent* formation.

Scirrhus of the mammary gland may occupy a portion of it only, in the rest of which many cysts may be formed, that are in no sense cancerous; or, the chief lactiferous tubes may be dilated into pouches or cysts, contiguous to, but quite independent of, the neighbouring cancer-growth. Such a cancer may nevertheless in its course enclose these cysts, and they remain for a time imbedded in its substance. The ovary may be the seat of cysts, and also the seat of cancer; the two growths thus accidentally associated, will probably become connected, although of independent origin. Further than this, cancers may grow from the *walls*



of common cysts—*i.e.*, of cysts which have not originated in cancer-structures. Medullary cancer, especially the villous form, sometimes grows from the walls of cysts which have themselves no cancerous appearance.

(2) Cysts *derived from cancer structures*—by their erring development and growth—constitute a series parallel with that of the cysts barren and proliferous, which form in innocent tumours, or in the natural textures. Cancer-cysts having this origin, are, therefore, either barren or proliferous.

Of the *barren* species are:—Cysts filled with serous fluid, variously tinted. Serous cysts are often born in cancers, especially in those of the medullary type, which grow quickly, or to a great size. One or many such cysts may be present on the surface or in the substance of a cancer. Sometimes a single cyst of this kind enlarges so as to surpass the bulk of the cancer, exceedingly perplexing the diagnosis. Sometimes many cysts are present, as if the tumour were entirely composed of them, with cancerous structure only in their interstices. Sanguineous cysts are born as often as serous, in medullary and other cancers. The imprisoned blood undergoes changes in respect of colour and consistence, thereby diversifying considerably the appearances presented by cancers containing these cysts. Colloid cysts, *i.e.*, cysts containing a glairy jelly—not cancerous—may likewise be developed in cancer-growths, by conversion of their structural elements.

The *proliferous* cysts which originate in cancers, bear on their inner surface cancerous growths—thus corresponding with the glandular growths which spring from the interior of cysts in the mammary and thyroid glands. These endogenous growths are often found in the alveoli of colloid cancer. Clusters of clavate, or flask-shaped villous processes, resembling those formed in the early stages of “dendritic vegetation” of villous cancer, spring from the wall of the alveolus.

The *origin and modes of development* of these cysts—simple and proliferous—have been traced by Rokitsky, and shown to correspond with those of all other cysts: the only difference being the *source* of the cyst-formation—here a cancerous element, while in respect of all other cysts it is an element of some natural tissue.

*Situation.*—The preference of Cancer for different tissues and organs, ranges according to the following average scale. (Rokitsky.)

“First; the uterus, the female breast, the stomach, the large intestine and especially the rectum; next, the lymphatic glands, especially as retro-peritoneal cancer-accumulation in front of the vertebral column; hepatic, peritoneal, cancer; bone-cancer; cancer of the skin, and of the lips; of the brain; of the globe of the eye; of the testes; of the ovary; of the kidneys; of the tongue, and the œsophagus; of the salivary glands and parotid;”\* to which I may add—without pretending to determine their relative places in the scale of frequency,—cancer of the urinary-bladder, of the pancreas, and of the spleen; in each of which organs I have seen, as already described, masses of colloid. In the remarkable case referred to, other organs were similarly affected; the stomach, intestinal canal, uterus, ovaries, and rectum.

This scale does not specify the particular *species* of cancer, in each of the different tissues and organs named; yet their relative liabilities in this

\* Pathological Anatomy. Translated. Syd. Soc., 1854, vol. i.



respect is a matter of great practical importance, considering the unequal degrees of "malignancy" evinced by the several species of this growth.

(1) *Encephaloid-cancer*—the most malignant species; selects first, in order of frequency, the *testicle*; next, the bones and particularly the femur (Paget); the intermuscular cellular texture of the limbs; the eyeball or orbit; the breast; the walls of the chest, or abdomen; the lymphatics. Moreover, encephaloid "occurs in organs in which no other cancer, least of all scirrhus, ever occurs,—as in the liver, the kidneys, the lungs, the testicle, the lymphatic glands." (Rokitansky.)

Encephaloid cancer is not usually *solitary*. It commonly co-exists in many textures and organs.

*Melanotic cancer*—mostly a variety of encephaloid, by pigmentary degeneration of its cells, and the most common of all melanotic tumours—is prone to grow first, in or beneath pigmentary moles (Paget); or selects first the liver (Rokitansky); but it may occur "in the brain and about the nerves; at the eyeball, in the lungs, thyroid gland, liver, spleen, kidneys, bones, lymphatic glands, ovaries, in and beneath the intestinal mucous membrane, between the mesenteric layers, in the skin and subcutaneous areolar texture, upon serous membranes, in the dura mater, upon and within the heart."

This variety of cancer occurs as secondary formations, in very many textures and organs, simultaneously.

*Villous cancer*—another variety of encephaloid—is produced, according to Rokitansky, exclusively upon membranes; more especially upon mucous membranes, and most of all that of the male *urinary bladder*, near the opening of either ureter; next to this the mucous membrane of the stomach, and in particular the pyloric portion. It has been observed suspended by a pedicle from the internal membrane of the rectum, and even from that of the gall bladder. Secondly, it is very apt to grow extensively from the internal wall of ovarian cysts—*cysto-carcinoma*—where it is recognised as villous cancer by its copious accompaniment of medullary sap. In these cases, it is often concurrent with cancerous infiltration of the lymphatic glands about the lumbar vertebræ, and with peritoneal cancer—representing villous cancer upon a serous membrane. It has been observed also upon the dura mater; occasionally upon the general integument; and perhaps in bone. Lastly, it occurs in *parenchymatous organs*.

(2) *Scirrhus* cancer selects first the *breast* in the proportion of 95 per cent. (Paget.) Next, in order of frequency, the stomach; perhaps still more frequently, in this organ (Rokitansky); then, according to the last-named authority, the colon in its sub-mucous cellular tissue; more rarely in the vaginal portion of the uterus; upon serous membranes, and in the subserous areolar tissue. Again, as an expansive degeneration of the omentum, and of the mesentery; in the salivary glands; in the fibrous tissue of the bronchi. In several of these, as well as in other structures,—for example, the ovaries and the brain,—there occur "cancerous growths of embryonic composition, and in all likelihood of fibro-cancerous (scirrhus) nature." To this list may be added cancer-growths *secondary* to scirrhus, and which, in proportion as they are consecutive, incline more and more to the condition of encephaloid; for example, of the lymphatic glands, the bones, muscles, skin.

Scirrhus cancer is not unusually *solitary*.

(3) *Colloid-cancer* selects the *stomach* and *large intestine*; the serous

membranes, and particularly the peritoneum. In other textures and organs this species is mostly *secondary*; as in the lymphatic glands, the lungs, the ovaries, the bones, the breasts; "and in rare cases, the kidney, uterus, and liver." (Rokitansky): to which I may add, the pancreas, spleen, and urinary bladder.

Colloid cancer is usually *solitary*.

ORIGIN.—*Age* has no definite influence on the production of Cancer; the three species having been known to originate at every period of life. Even during intra-uterine life, scirrhus in the heart was found in one case. At birth, meningeal cancer, and instances of cancer affecting other organs, have been found. In infancy, childhood, maturity, middle age, the decline of life, and extreme old age—even at ninety-three—cancer is liable to occur. But certain periods of life are prone to cancer growth, as indicated by its mortality; the tenth to the fifteenth year is least liable, the thirty-fifth to the eightieth year, and perhaps to a later period, is most liable, the tendency increasing with each succeeding decennial period. There seems to be a more rapidly increasing tendency after thirty and onwards for some years, as compared with the same number of years before that period; the proportion of deaths, in both sexes, from the age of thirty to forty increasing to six times more than between twenty and thirty.

*Sex* much affects the liability to cancer. Thus, from forty to fifty years, in females, the mortality increases sixfold; whereas, in males, the number of deaths increases only two and a half times.

*Sex* in relation to *Species*.—Scirrhus is more common in the female; epithelial cancer, in the male.

*Age* in relation to *Species*.—Encephaloid occurs most frequently in infancy and youth; scirrhus, in adults, it being uncommon before puberty or even the thirtieth year; colloid in adults only, or excessively rarely, if ever, before the thirtieth year.

*Hereditary* tendency.—Evidence in this direction may be resolved into two general facts. In some families cancer is known to have occurred in more than one individual. Mr. Sibley traced it among cancer patients at the Middlesex Hospital, in one case of every nine; by Mr. Paget, in one of every six cases. Mr. Arnott and Mr. De Morgan each had charge of members of a family in whom disease was thus exhibited; the father and his relatives were healthy, the mother died of cancer of the breast, two of her sisters of phthisis, and one of dropsy. Of six daughters, five had cancer of the breast, the youngest was still healthy, and the only son died of phthisis. On the other hand, to give some force to such observations; some *entire* families are exempt from the disease.

*Constitutional* tendency to cancer can only be inferred—yet the inference is strong—from the apparently negative relation of this disease to any *external* causes. The various presumed external causes of chronic maladies shall continue in operation in many individuals, for a length of time with every degree of intensity and in all possible modes of combination, *without* producing the slightest manifestation of cancer; and cancer exercises its most fearful ravages in persons who have never been influenced by any such causes. Excluding, therefore, external causes, some internal and individual, or constitutional tendency must have been in operation.

On the other hand, there are reasons for believing that cancer, like syphilis, is primarily *local*, and only secondarily, constitutional. Velpeau is, perhaps, the leading authority who supports this position;

and the reasons adduced are thus stated by Mr. Erichsen in his work on Surgery :—

(1) Cancerous tumours spring up in individuals who have always enjoyed perfect health, and who, to all appearances, are perfectly well at the time of the occurrence of the disease.

(2) These tumours are not unfrequently the result of some local injury or irritation.

(3) The constitutional health does not, in the majority of cases, appear to suffer until some months have elapsed; when, as the lymphatics or glands become implicated, or neighbouring tissues invaded, signs of cachexy set in.

(4) If the disease be removed before neighbouring parts have become contaminated, the health, if it have suffered, often improves materially.

(5) The patient remains free from any recurrence of the disease for a considerable period; in the great majority of cases.

(6) In some instances, no recurrence whatever takes place, the disease being eradicated from the system, which could not be the case if it were constitutional.

(7) Recurrence having taken place soon after an operation, it is almost invariably either in the cicatrix or in its immediate neighbourhood; owing to cancer-cells which had been widely infiltrated escaping removal; and subsequently developing into a new tumour. Were the disease constitutional, recurrence would be as likely to take place in other parts, or in internal organs, as it does when the operation has been too long delayed.

(8) The same tendency to recurrence after removal, and even to secondary deposit in distant organs, is observed in respect to other tumours which are incontestably, primarily local—*e.g.*, the fibro-plastic and the enchondromatous, and which only become constitutional in their more advanced stages, and in a secondary manner.

This last proposition seems to me fallacious; both the tumours adduced being “localized” growths, although the fibro-plastic or myeloid variety of enchondroma is undoubtedly a recurring tumour.

*External causes.*—*Injury* or irritation, is not found to have more than a limited influence on the production of cancer. A broken tooth scratching the tongue or cheek, may induce the disease in either of these parts; the friction of a clay-pipe, constantly used, may excite cancer of the lip; and the irritation of soot in contact with the scrotum or prepuce appears to induce the well known chimney-sweeper's cancer of those portions of integuments. In all such cases, the cancer produced is the epithelial variety.

*EFFECTS of Cancer, as an internal cause.*—(a) *Locally.*—*Pain* may be regarded as an effect, produced, apparently, by compression of the nerves in, and around, the cancer-growth; by separation of their fasciculi and fibrils with interstitial deposit; and, in the case of scirrhus by dragging of the nerves as the growth contracts. Pain is, therefore, due rather to a *mechanical* operation of the tumour, than arising from any vital endowment of the growth itself, which is in fact comparatively destitute of nerves. *Encephaloid* cancer, especially, is of this character; the tumour scarcely seeming to be sensitive, when cut into during a surgical operation for its removal.\* *Scirrhus*, however, seems more especially to

\* System of Surgery. Edited by T. Holmes. Cancer, by C. H. Moore, vol. i. p. 526.



give rise to pain from *within* itself, the pain radiating thence along the nerves.

The kind and degree of pain vary considerably. Lancinating pangs, particularly when the tumour is handled, are commonly experienced in scirrhus. A hot dart, molten lead, and other such expressions are also used to denote both the character and severity of the pain in this species of cancer. The pain of encephaloid is generally less severe; and colloid is comparatively painless. In cases taken indiscriminately the pain differs; a dull aching sensation, a feeling of weight and coldness, distressing itching, represent these varieties.

The pain varies also in point of date, duration, and constancy. Thus, it is not generally of early occurrence; being absent in most cases of scirrhus breast, for the first year or year and a half. Its duration is temporary; occurring occasionally, as when the breast is handled. And cancer, not uncommonly, runs through its whole career without any pain. It is absent in about one-fifth of the cases, including all organs and localities. (Walshe.) The pain is usually proportionate to the rapidity of growth; becoming more severe and persistent when the tumour is inflamed or ulcerating or about to slough, and acquiring the hot burning or scalding character.

*Derangements of function* are produced, some of which are *irritative*; as pleurisy and hydrothorax by mammary cancer, peritonitis by ovarian cancer, vaginal discharge by non-ulcerated scirrhus of the uterus. Other derangements are *mechanical*; as effusions by the compression and obstructions of blood-vessels, spontaneous fracture with cancer of bone, stricture of the urethra or bowel, pressure on the brain, spinal cord, or nerves, inducing paralysis, partial or complete, pressure on the optic nerve or from within the eyeball, impairing or destroying vision.

(b) *Constitutional effects*.—The functions of the various parts of the body, other than of the part affected, may continue uninterruptedly for a longer or shorter period as cancer advances. Thus then the general health remains unimpaired, independently of the local disease. Conversely, the *growth* of cancer is inversely proportionate to the general health; being temporarily arrested, if it remain unaffected or is maintained, and coming into activity as it declines. Consequently, with advancing age, there is, so far, a greater liability to cancer; and particularly of the uterus, during the decline of generative power. In like manner the functional vigour of any part of the body apparently protects that part against the production and growth of cancer; whereas the decline of such vigour has the opposite tendency. Thus, pregnancy and lactation protect the uterus and breasts, respectively; while the cessation of those functions is favourable to cancer-growth in these organs. The supervention of either of the functions referred to, is, however, sometimes accompanied with a rapid extension of the disease, or the tumour may remain unaffected by these local changes.

*Cachexia* is the term used to denote all those functional derangements, chiefly of the circulation, nutrition, and innervation, which together represent the constitutional condition. Feverishness, loss of appetite, nausea and vomiting, distressing thirst, imperfect digestion, obstinate constipation or diarrhoea, *progressive emaciation* with *peculiar yellow sallowness*, muscular weakness, sleeplessness, and melancholy; such are the leading phenomena of this condition. They are somewhat proportionate to the amount and diffusion of cancer-growth in the system; and hence



are more pronounced when it appears in different parts successively, as secondary cancer, and as affecting especially the great internal organs, which minister to the nutrition of the body. Cancerous cachexia is most marked in scirrhus, and least in colloid cancer; encephaloid taking an intermediate position, but being more nearly allied to colloid, in this its constitutional influence.

*Co-existing Diseases.*—Diseases of various kinds may co-exist with cancer, without apparently influencing it, or being influenced by it. Thus, Bright's disease of the kidney has no effect on the course of cancer, which may proceed favourably, even to withering and complete cicatrization, independently. Extensive skin disease, syphilis, caries of the spine, fatty and cirrhotic liver, may severally co-exist. "But, observes Mr. Moore, exanthematous fevers are unknown in the cancer wards of the Middlesex Hospital, excepting erysipelas, which is not less common in such patients than in others. Erysipelas sweeping over a cancerous ulcer will sometimes efface its specific characters, rendering it a healthy, granulating, and cicatrizing sore. In a few days, or weeks at most, the original kind of ulcer has reappeared. Hospital gangrene, occasionally, has a similar temporary effect, and ultimately the same result. Apoplexy and heart-disease seem to have some protective influence against the production of cancer. Tubercle appears to be no less manifestly incompatible with cancer, while yet related to it." Traces of old tuberculous disease are remarkably common in the bodies of persons dying with cancer, and in 34 per cent. of them phthisis exists in the family; yet the two diseases are never found in active growth together in the same person. Active tubercle co-existing, supplants as it were, cancer, which may wither and even cicatrize as the patient is rapidly dying of phthisis.

*COURSE.*—In the vital history of cancer, certain aspects of its progress, subsequent to the more immediate effects already stated, are particularly worthy of observation.

*Rate of Growth.*—Encephaloid cancer takes the lead, growing generally to some dimensions in a short time, or even with vast rapidity. Scirrhus grows more slowly. Colloid with a medium degree of rapidity.

*Duration of Growth.*—Scirrhus is of longest mean duration, averaging three or four years; encephaloid is of shorter mean duration, averaging about two years; colloid holds a middle place also in this respect.

Sex appears to have but little influence on either the rate or duration of growth.

Age seems to have some influence; the progress of cancer, generally, being more rapid in the young, and chronic in old persons.

*Arrest and Decay.*—These changes consist in a cessation of growing, and a destruction of the proper structural elements of the tumour. Cells and nuclei break up, oil-globules and granules are substituted. The chief element in a *withering* cancer is fat, thus contrasting with the general emaciation of the body.

*Softening*—which contrasts with the hard withering of cancer—takes place, principally, in encephaloid, its soft cancer. It then consists of matter having a creamy or milky appearance, very slightly viscid, and the consistence of soft cheese or thin pus. The proportion of milky opaque fluid, yielded on gentle pressure, indicates the progress towards this change. As affecting colloid cancer, softening represents, not perhaps any further change in its already jelly-like matter, but the breaking down

of its containing stroma, with rupture of the loculi and escape of their contents.

The commencement of softening, in any species of cancer, is either at the circumference or centre of the tumour; and in a single spot, or in several spots, simultaneously.

Age seems to have no definite relation to these changes. In old persons, the arrest of cancer is not an uncommon event. One such case, under the care of Mr. Cooke in the Cancer Hospital, was that of a healthy-looking woman, with a ruddy complexion, and aged eighty-two. Scirrhus of four years' duration existed in her left breast, and she had been an out-patient just twelve months. Another instance, in the University College Hospital, was that of a woman aged seventy-seven. The disease had existed for seven or eight years, but was progressive during the last eight or nine months.

**TERMINATIONS.**—(a) *Resolution and Absorption* is one mode of *spontaneous cure*. Thus, an encephaloid cancer of the eye of an infant ultimately disappeared, and was followed by dropsy and atrophy of the eyeball. Scirrhus of the breast disappeared in a lady whose other breast had been extirpated for this disease. But, in this case, scirrhus was found in several of the abdominal viscera; the patient having died of asthma not long after the subsidence of the breast-cancer. (b) *Suppuration* is another mode of spontaneous cure. A man had a large scirrhus tumour removed from his back. The disease returned. No operation was again performed; but subsequently violent inflammation supervened, an abscess followed with profuse suppurative discharge, and then recovery. (c) *Mortification* may extirpate a cancer, though rarely. The whole tumour is eliminated by sloughing in a mass. [P. p. 808.]

**Cancerous Ulceration and Ulcer.**—The former consists in the molecular disintegration or destruction of the structural elements of the textures, as in ordinary ulceration, preceded, however, by interstitial infiltration circumferentially; thus differing from ordinary ulceration. And the infiltrating cancer-elements, although themselves dying, seem to exercise a destructive influence over the proper textural elements.

The *ulcer* resulting from this process, presents certain appearances which are most characteristic in the scirrhus ulcer. Of variable size and shape; the edges, at first perhaps thin, irregular, and level with the surrounding surface, or sunken, undermined, and inverted, become thickened, elevated, and everted—a condition commonly observed. The bordering skin acquires a bluish red, or brown tint; and the surface, excavated and irregular, presents large prominent granulations, or a base of slough and blood. A thin, greenish, fetid, and acrid discharge—*ichor*, oozes from the ulcer. Other changes may occur which more or less obscure these appearances, but they are chiefly exceptional or accidental. *Hæmorrhage*, for example, may be profuse, and particularly from the ulcer of encephaloid cancer. The capillary vessels are the usual source of this hæmorrhage; but it sometimes proceeds from erosion of the larger vessels, or from rupture of the varicose veins communicating with the ulcer. An admixture of melanotic matter may occur, as seen also in the ulcer of encephaloid cancer. Then again, a cancerous ulcer is subject to those pathological processes which affect an ordinary ulcer; as inflammation and phagedæna.

A cancerous ulcer enlarges slowly or rapidly, both circumferentially and in depth, the whole area of the textures being infiltrated with cancer-

elements. Consolidation increasing, the ulcer becomes firm and fixed, both in its margins and base; scirrhus ulcer especially acquires these characters, like this species of cancer in the course of its growth. Hardness and immobility, superadded to the appearances of margin and surface already described, renders the cancerous ulcer more characteristic.

*Cicatrization and Cicatrix.*—Paradoxical as it would seem that any process of healing should take place in a cancerous ulcer—itself inherently destructive and texturally indisposed to heal—nevertheless, cicatrization supervenes occasionally. Unlike that of an ordinary ulcer, this cicatrization rises over the prominent granulations and dips into the hollows of the ulcer. In the majority of cases, the process and its result are only temporary; as when erysipelas sweeping over a cancerous ulcer renders it a healthy cicatrizing sore, for a time. But, in some cases, the healing is established, and a sound cicatrix permanently formed. This has occurred in the ulcers of both scirrhus and encephaloid cancers. Of such unusual permanency, a case is related by Nicod, and several others were observed by Bayle. [P. p. 808.]

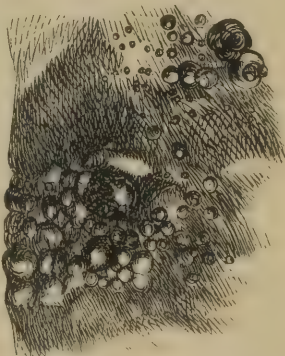
The *Cicatrix* of a cancerous ulcer is, in some respects, peculiar. It is extremely thin, of a red or violet colour, and often traversed by large vessels. Contraction is restrained by the firmly adherent skin around, the cicatrix is thus rendered very tense and even more attenuated, and disposed to ulcerate again.

*Recurrence of Cancer, locally.*—This is a very common event in the vital history of cancer, whether after its separation spontaneously, or removal artificially by the knife. Local reproduction takes place under different circumstances, which are classed, by Dr. Walshe, as follows.—(a) The process of cicatrization may not distinctly commence, or be interrupted at an early stage, and fungating growths spring from some part of the ulcer or wound. (b) A perfect cicatrix forms, and after a variable lapse of time, a tumour grows in the subjacent tissues, presses outwards the newly-formed scar, destroys it, and appears externally with the characters of cancer. (c) In the cicatrix itself, reproduction may occur, by the development of tuberiform cancerous growths. (Fig. 26.) Encephaloid is the species of cancer usually presented, whatever was the original growth. Colloid perhaps never forms consecutively to either of the other species of cancer-growth.

Recurrent cancer is said to grow more rapidly than the primary cancer.

*Dissemination of Cancer in the System, —Secondary Cancer.*—(a) In textures *continuous* with that, or those, of the original growth. Continuity of tissue is here the medium of communication, directly permitting of infiltration. The textures which thus convey the cancer-elements, may be naturally continuous, or connected by adhesions. Of the former,

FIG. 26.\*



\* Returning scirrhus in the breast, after operation; presenting a series of nodules in and around the cicatrix. One in the centre has ulcerated. (Cruveilhier.)



Mr. Moore saw an instance where the only cancer in a lung was a small portion of an out-growing cancerous gland of the posterior mediastinum, and the only infected absorbent in the root of that lung was one of considerable size, not more than an inch from the implanted cancer. (*b*) In *contiguous* textures also cancer may, apparently, spread, without any direct medium of infiltration. Thus Dr. Hodgkin and other pathologists mention cases, in which an ovary, the mesentery, or the liver, being the seats of cancer—the parts in contact with those organs, as the intestine, the walls of the abdomen, the supra-renal capsule or kidney itself—became similarly diseased. (*c*) In textures and organs *remote* from the original growth, secondary cancer may appear.—(*a*) The *lymphatic* vessels are undoubtedly one channel of transmission. The almost unexceptional infection of the lymphatic glands in the neighbourhood of a cancerous growth,—and which is, indeed, one of the generically distinctive characters of cancers, as a growth—supports this view. Such infection, in relation to primary cancer, is parallel to bubo, in relation to chancre. Either, however, may also be regarded as part only of the primary disease. But cancer can be traced further in the lymphatic system, progressively infecting glands more and more remote from, yet still directly connected with, the part in which the growth first appeared. Surely this diffusion of cancer is secondary. In only about one out of every forty-three cases of fatal cancer is there secondary deposit in internal organs, without infection of the intervening lymphatic glands, *en route*, connected with the site of the external primary disease. (*β*) The *veins*, and venous circulation, would appear to be far less a medium of transmission. Cancer-elements having entered the venous system, through the thoracic duct, the lung as the proximate organ, would next become the seat of cancer-deposit. Yet, in 173 cases of cancer, the lymphatic glands were infected in 140, the lungs in 22 only. The fact, however, of both these organs being affected, in most cases, and simultaneously, indicates the agency of the pulmonary venous system. (*γ*) The *arteries* and arterial circulation are engaged even less definitely than the venous circulation. Arterial blood flowing to all parts alike, they are not equally prone to cancer. The liver is first in order, thus contrasting with the lungs, among internal organs. It was the seat of secondary cancer in 60 of 173 instances taken indiscriminately, and in 60 of only 90 cases in which the disease spread at all beyond the lymphatic glands of the part first affected. The kidney is far less liable,—it was attacked with consecutive cancer twice only in 173 cases; and the spleen but once in that number. The bones and serous membranes, are both commonly invaded. These differences of liability suffice to show the extreme irregularity of secondary cancer, in its presumed relation to the arterial circulation, as the medium of transmitting cancer-elements from the primary growth.

One general law respecting the dissemination of cancer in the system, would seem to be this;—it is regulated, in some measure, by the retention of cancerous matter within the body, or its discharge externally through the integuments by ulceration or through some natural passage. Cancer of the uterus with free discharge per vaginam, is followed by secondary cancer in not more than 25 per cent.; whereas deep-seated cancer of the breast produces secondary cancer in 79 per cent. In calling attention to this important general fact, Mr. Moore justly adds, there are covered cancers, though very few, which remain solitary to the



end of life, and there are cancers on free surfaces which do become disseminated.

The successive dissemination of cancer in the system, or primary and secondary cancer, must not be confounded with the *simultaneous* dissemination of cancer, or the production of more growths than one, in different parts, at the same time. The total absence, probably, of functional symptoms, at an early period is apt to mislead—*e.g.*, in cancer of the brain, lungs, liver, and stomach, organs of leading functional importance. Thus cancers which are apparently successive may really be simultaneous.

The *relative tendency* of the three species of cancer to affect the system secondarily, differs with respect to each. Encephaloid and scirrhus seem to dispute the first place in this aspect of their vital history. But colloid undoubtedly has here the lowest rank, as also in the other characters of malignancy.

*Species and shape* of secondary cancer—Encephaloid is produced in the majority of cases; Scirrhus far less frequently, and even rarely. Colloid has not yet been found, in any case recorded. (Walshe.)

The nodular form is that which secondary cancer usually assumes, especially in the liver, lungs, and bones. In a cicatrix, as after excision of a cancerous breast, this form of secondary cancer is very common. Nodules or button-like tubercles appear which spread and coalesce; or a hard ridge forms in the line of cicatrix. In either case the colour, whitish at first, deepens into a purplish-red hue.

In proximate lymphatic glands, secondary cancer produces—and probably at an early period—tenderness, enlargement, and induration, increasing even to bulletty hardness.

*Termination by Death.*—This, the natural and most frequent issue of cancer, takes place in various ways, which may be concurrent or successive. (a) By the *constitutional* influence of the disease on nutrition and blood-production, as manifested by cachexia; the proper cancerous death. (b) The direct influence of the disease, *locally*, on various functions—*e.g.*, of the liver, stomach, œsophagus, intestines. (c) Hæmorrhage, internally or externally—*e.g.*, Cancer of the uterus. (d) Exhaustion from pain and discharge—*e.g.* Cancer of the uterus. (e) Mortification—*e.g.*, cancer of the limbs. (f) Intercurrent diseases, generally of the inflammatory class—*e.g.*, pleurisy, or pneumonia, by cancer affecting the ribs and lung. (g) Substitute diseases—*e.g.*, Phthisis supplanting cancer; tubercular deposit (in the lungs) being pathologically equivalent to the cessation of cancer-growth in some other part of the body.

*TREATMENT.*—Naturally incurable and fatal as cancer is, generally, it may undergo certain structural changes of a self-curative character, the purpose of which it should be the aim of therapeutics—medical and operative—to imitate. To establish this correspondence between the treatment of injuries and diseases and the processes of Pathology, in respect to their natural courses and tendencies, is one of the leading features of modern Surgery; and this relation of art to the indications of nature, is better illustrated by the treatment of Cancer than by that of any other Morbid Growth.

1. *Arrest of Cancer, and Hygienic and Medicinal Treatment.*—The natural arrest and decay of cancer consists in the cessation of growth, and the disintegrative destruction, of its proper structural elements; changes which are accompanied with, and denoted by, *withering* of the Tumour.

This course and termination are observed mostly in the career of scirrhus, as witnessed best in the puckered-up chronic mammary cancer and shrivelled breast of old women. No known medical treatment seems to insure this result; although iron, bark, cod-liver oil, the anodyne influence of opium, and such other medicinal agents as, apparently, improve nutrition; are auxiliary. But hygienic measures, especially in the shape of a generally nutritious and easily assimilated diet, and a cheerful, hopeful tone of mind, are most efficacious. The growth of a cancer-tumour is inversely proportionate to the arrestive influence of the general health. Thus, when the body is well nourished, the tumour starves.

*Local* applications are advantageous resources occasionally. Any temporary supervention of inflammation may be treated accordingly, by a few leeches or a light poultice. Pain recurring or persistent, and affecting the general health, is often mitigated by a belladonna plaster, or by conium or opium ointment. A scruple of the iodide of lead in a drachm of glycerine, mixed with an ounce of unguentum opii, is recommended by Mr. Moore. Gently rubbed over the tumour two or three times a day, it reduces any swelling, as well as relieves pain. Soap plaster, used simply to protect, not to compress, the integument, is also calculated to retard the progress of the growth.

Compression may control pain, but its efficacy in repressing growth is doubtful. First tried at the Middlesex Hospital many years since, it was unfavourably reported on by Sir Charles Bell; subsequently, highly extolled by Recamier—who stated that 30 per cent. of his cases were cured, and advocated by Dr. Walshe—it has, nevertheless, not found much favour in this country. Compression is best effected by means of the air-cushion and spring, devised by Dr. Neil Arnott. Pressure varying in force from two-and-a-half to twelve or sixteen pounds can thus be brought to bear on the tumour.

2. *Sloughing and Enucleation*; (a) *by cauterization*.—This method of treatment is warrantable only in cancer which is already *ulcerated*, and has acquired adhesions beyond the fair reach of the knife.

Cancerous glands, as an extension of the disease, are not so conveniently removed by the application of caustic. But they, and the textures around the slough, mostly become notably diminished in size; an important fact with reference to the glands, compared with their progressive enlargement after removal of the primary tumour by excision. Velpeau's observations seem to confirm this difference in favour of treatment by caustic. It may be followed by successful results, but of temporary duration; a few weeks only—if the disease be incompletely extirpated, or lasting until after the wound has healed—if a healthy granulating surface was obtained. Subsequently, in either case, cancer reappears, *in situ*, and runs its course with rarely an exception to a fatal termination.

As compared with removal by the knife; the advantages of cauterization are, the bloodless character of the operation and, consequently, less exhaustion, and the less liability to erysipelas or pyæmia; the disadvantage is, the pain, severe and persistent.

The caustics employed are, the concentrated mineral acids, sulphuric or nitric, or the solid caustic alkalies,—potash or lime, and various chlorides, that of zinc especially. Of all these, the glacial sulphuric acid mixed with powdered saffron—forming a black paste, is preferred by Velpeau, particularly in fungoid and bleeding cancers. The caustic alkalies combined, form the well-known Vienna paste. The chloride of zinc

mixed with flour readily forms a paste by deliquescence. If a liquid caustic be used, the surrounding skin should be protected by a barrier of gutta-percha or other similar material attached to the skin. If chloride of zinc be used, the skin, which resists this agent, must previously be destroyed by sulphuric or nitric acid.

The depth to which the action of any such agent extends and the destruction of the tissues accordingly, will depend on the strength and quantity of the caustic employed. But the result can only be roughly estimated. The slough produced varies in appearance with the kind of caustic employed; a dry, hard, contracted blackish eschar, resulting from the application of a strong mineral acid; a wet pulpy slough, from chloride of zinc. It separates after a time, a few days to a month, disclosing a healthy granulating surface, but perchance, of prodigious depth and extent. Other modes of applying caustic have, therefore, been devised. The *repeated* introduction of chloride of zinc through incisions daily made deeper and deeper, affords a precaution for limiting the slough to the depth and extent of the cancer. This plan of treatment was first practised in this country by Dr. Fell, of the United States; a Report on which was drawn up by the Medical Staff of the Middlesex Hospital, in 1857. Another mode is to undermine a cancer with caustic, introduced through narrow passages pierced with a seton needle.

Of all these caustics and modes of their application, my own experience inclines to the chloride of zinc, which I first saw used by Mr. Liston about twenty-five years ago, and the efficacy of which has since been attested by its results in some cases.

In the ulcerated stage of cancer, disinfectants are requisite, for the double purposes of cleansing the sore, and of counteracting the effects of that peculiar fetor which would otherwise encompass the patient in a self-created poisonous atmosphere. Charcoal or yeast poultices, and lotions of chloride of lime or carbolic acid, are thus beneficial. I can speak favourably of the latter poultice and lotion. They were remarkably efficacious in the case of a large cancer springing from the arm and involving the shoulder. Ulceration having commenced in front of the axilla and subsequently, in other parts of the tumour; the odour would have been intolerable to the patient but for these appliances.

(b) *Congelation*.—The continued application of intense cold, is another means of destroying a cancer. Used in conjunction with caustic, congelation mitigates the pain, without diminishing the cauterization. Freezing is, alone, far less effectual. When most successfully practised, its destructive action extends not deeper than an inch; the only advantage then being the freedom from pain during and even after this process. As a method of treatment for cancer, it was introduced by Dr. James Arnott. Pounded ice may prove sufficient; but a mixture of ice, salt, nitrate of potash and hydrochlorate of ammonia, will freeze more thoroughly. The frigorific mixture should be circumscribed by gutta-percha or other pliant material, fashioned into a bowl around the part, with a tube to drain off the fluid as the mixture melts; and the process must be continued for some hours.

3. *Excision*, or *amputation*, for the *immediate* removal of cancer, is the treatment most worthy of consideration. Granting the local origin of cancer, and thence the subsequent infection of the system; excision—as distinguished from any *process* of removal—is indicated, and at the earliest possible period. Hence also amputation, where practicable,



may be preferable to excision—a partial operation, which may not thoroughly extirpate the disease. The delay of either operation, will assuredly allow the infiltrating course and adhesions of cancer to ensue, thereby rendering it locally impracticable or constitutionally useless.

These pathological considerations suggest certain general reasons in favour of both excision and amputation, and their comparative advantages.

(1) Extirpation of the disease, entirely and permanently. This is very rarely accomplished.

(2) Temporary removal of the disease, and thence a proportionate restoration of ease and health. This immunity is always gained.

The period of non-recurrence varies; perhaps less than one, it averages two years. Early performance of the operation may prolong this period to ten, fifteen, or twenty years. Such prolongation has been observed particularly in scirrhus affecting the breast. The experience of Velpeau and of Sir B. Brodie concur as to the long period of immunity which may be enjoyed.

(3) Prolongation of life. Comparing the duration of life in cases, without operation, and after: Mr. Paget states that, in the former case, the average period scarcely exceeds two years; whereas, in the latter, it extends to about twenty-eight months. Mr. Moore goes much farther, observing, that in 78 cases of cancer affecting the breast, not operated on, the average duration was 32·25 months; and in 57 such cases the average was 53·2 months. Any estimate of this kind is liable to a twofold error; the selection of cases for operation is generally those most favourable to life, and the probable mortality of the operation itself. The latter varies from 5 to 10 per cent.; and albuminuria peculiarly predisposes to a fatal issue. Objections with regard to each of the three foregoing considerations may be raised as to the propriety of operative interference, but the same objections apply with equal or greater force to any kind of treatment whatever, in the course of a disease so, apparently, irregular as that of cancer.

The conditions of cancer, or the cases which are respectively favourable and unfavourable for operation, may be stated, approximately, as follow; cancer of the breast being taken as the type:—

(a) *Favourable for operation.*—(1) A single tumour, not diffused, and whether in the nipple, on the surface, or in the substance of the breast. (2) When the nipple alone, or some portion of the skin, is drawn in towards the subjacent tumour. In either case, the superficial part not being widely infected but simply dimpled, the breast may be removed. But the disease is apt to return in and around the cicatrix. This took place in the case of a scirrhus breast which I removed in the condition described, a small portion of skin not larger than half-a-crown, being attached to the gland. (3) Ulceration of a cancerous tumour does not preclude operation, if in other respects the case be suitable. (4) The glands having become diseased to an extent which does not interfere with their removal, is a condition proportionately favourable for excision of the primary tumour. But the state of the glands cannot be exactly determined, otherwise than in the course of the operation, and if then found to be cancerous, they also must be removed; not necessarily, however, at that time, if such an enlargement of the operation might be perilous. Subsequently, and as soon as the health permits, the cancerous glands should be excised. This postponement I had recourse to in the case of a lady whose breast I removed for cancer; when the wound had healed,



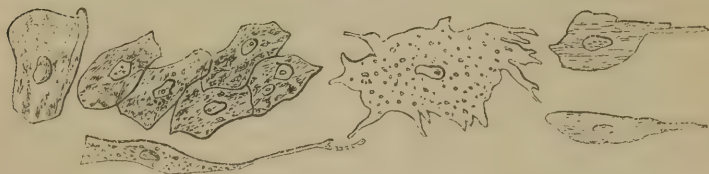
I then removed the axillary glands—by a more limited incision than a continuation of the original operation would have involved. The disease eventually returned in the breast-cicatrix. (5) Amputation of a limb is justifiable, although the glands show some hardening or doubtful enlargement. This rule applies both to the encephaloid and epithelial disease. (6) Hereditary tendency, strongly manifested, does not entirely prohibit operation. In a family, of which six members were the subjects of cancer, one sister underwent excision of the breast in 1845, and another in 1846. Both remained well, until in each, with a recent recurrence of the disease, a second operation was performed in 1856—eleven and ten years after the primary operation. In 1859 both patients were alive. (7) Recurrent cancer may be removed under the same restrictions, as with reference to a first operation. My own experience of operation in such cases, is not favourable. In two—the original disease having been mammary cirrhosis—one or two only small button-like nodules reappeared in the cicatrix, these were at once removed, yet the disease speedily returned again. (8) Age does not prohibit the removal of a growing cancer.

(b) *Unfavourable* for operation.—(1) Certain constitutional conditions—*e.g.*, cancer co-existing, especially in some internal organ, or marked cancerous cachexia, albuminuria or other grave organic disease. (2) Diffused cancer and persistent œdema. But the latter condition is significant only when circumferential; œdema remote, depending on obstruction to the circulation at the seat of disease—*e.g.*, œdema of the hand from cancer of the arm, is not itself a prohibitive condition. In such case, I have seen the swelling subside and recur; apparently with varying states of the circulation as connected with the growth of the cancer above. (3) Adhesion, if at all extensive, either of the skin, or subjacent textures, is decidedly prohibitive of operation. (4) Ulceration, otherwise than to a very limited extent and depth, is equally so. (5) Cancerous tubercles in the skin over a cancer, is a condition even more unfavourable for operation. Over a mammary cancer, increasing thickness of the skin, its widespread adhesion, and enlargement of the pores; constitute a decisive contra-indication. (6) The glands having become diseased to an extent which interferes with their removal, prohibits also removal of the primary tumour, either by excision or amputation. (7) Rapid growth, in any way, is decidedly unfavourable for operation. Hence most encephaloid cancers are better left alone, unless in a very early stage. (8) Cancers, the relations of which to important parts around, cannot be foreseen, are better not meddled with. Thus circumstanced, are cancers beneath the scalp, which often implicating the bone, penetrate the skull; cancer of the eye, which often involves the optic nerve; cancer of either jaw, particularly the upper, where it is apt to protrude into the maxillary sinus or the ethmoid cells; and cancers about the root of the neck. I once assisted my colleague Mr. de Méric in removing an encephaloid cancer situated about the sixth rib, below the fold of the pectoral muscle on the right side. The tumour was not larger than an orange, the skin unbroken, and it seemed moveable on the rib. Yet, on commencing the operation, the hæmorrhage was alarming, the rib gave way, and any further attempt was at once discontinued. The man, of florid complexion, became blanched with almost fatal syncope in a moment, and rallying only for a short time, he died of internal hæmorrhage; a warning in all such, and similar cases.

**EPITHELIAL CANCER.**—One *variety* of cancer I have reserved for special description; because, although in many points allied to encephaloid and somewhat to scirrhus cancer, it nevertheless presents very characteristic appearances, and possesses much surgical interest. I allude to epithelial cancer.

*Structural Condition and Diagnostic Characters.*—This variety consists essentially of cells or scales, resembling those of scaly epithelium, infiltrated among the component elements of the skin or mucous membrane, or sometimes among the textures of internal organs. Whatever portion of the skin or mucous membrane may be thus affected, the epithelial cancer-cell or scale has very much the same characters. (Fig. 27.) It is flattened, of an irregular outline, with usually a prolonged diverticulum

FIG. 27.\*



at some point of its margin, and of a variable size. It contains pale molecular matter, converging towards a central nucleus, which is clear, bright, and well-defined, round or oval, and very small in comparison with the cell; more uniform also in its shape and size. This nucleus is usually single. It may contain two or more minute granules, but rarely a bright distinct nucleolus.

Associated with these cells, are what Paget calls "brood-cells," or endogenous cells. They present many varieties of appearance, which may be regarded as the results of one or more nuclei, enclosed within cells, assuming, or tending to assume, the characters of nucleated cells.

The "laminated capsules" of Paget—"globes épidermiques," Lebert—are the most singular and characteristic structures of epithelial cancer, yet not peculiar to this disease; nor are they, apparently, special structures, for they consist of epithelial scales. These capsules are very large and spherical cysts, containing granular matter, nuclei, or cells, obscurely seen within them; and clustered so as to almost appear as if fused together; but each capsule consists of epithelial scales, superimposed in successive layers, thus forming a laminated capsule.

Such are the structural elements of epithelial cancer. They are found infiltrated—principally in the substance of the skin or mucous membrane—but not uniformly diffused throughout the component textures of the part affected.

The cancer-cells may predominate in the corium, forming a swelling very slightly elevated above, or imbedded below, the proper level of the integuments, and the depth or thickness of which is much less than its dimensions laterally; or these cells may predominate in the papillæ, presenting a prominent warty or exuberant out-growth; or, the sub-integu-

\* Epithelial cancer-cells or scales in various forms. Magnified 350 times. (Paget.)

mental texture may be their chief seat, forming a deeper-seated, flat or rounded mass.

Of these varieties, the first two may be named the *superficial* or *out-growing*; while the third is the *deep-seated* form of epithelial cancer. Paget believes that either of these principal varieties may occur in any of the usual seats of this disease, but that they are not both equally common in every such part. The superficial, and especially those which have the characters of warty and cauliflower-like out-growths, are most frequently found on mucous membranes, especially of the genital organs; those also on the extremities and the scrotum have usually a well-marked warty character, and are rarely sub-integumental. The deep-seated are more frequent in the tongue than elsewhere.

It must not be forgotten, however, that these distinctions are more *apparent* than *essential*. Their value consists in reference to the earliest and most exact diagnosis of this disease, in whichever form it may chance to make its first appearance. For subsequently, and especially when ulceration has commenced, an epithelial cancer which was superficial or exuberant, is prone to extend into deep-seated parts; and one at first deeply-seated may grow out exuberantly. Moreover, when ulceration is progressing, a greater uniformity of external appearance is found; because, in general, while all that was superficial or exuberant is being destroyed, the base of the cancer is constantly extending, both widely and deeply, into the sub-integumental tissues.

Respecting, then, the *earliest* appearances of epithelial cancer, the following are most diagnostic.

1. Of the *superficial* or *out-growing*, prior to ulceration, they are these:—

(a) An *outspread* swelling arises—say on the lower lip, labium, pudendi, or scrotum; and an unnatural firmness or hardness of the affected

FIG. 28.\*



skin is perceptible; but the superficial dimensions much exceed the

\* Epithelial cancer of hand; showing the papillary character, from specimen in the Museum of St. Bartholomew's. (Ser. x. i. 6.) The history of this case is in Pott's Works by Earle, iii. 182. The patient was a gardener, who had been employed in strewing soot for several mornings. The disease was of five years' duration. (Paget.)



thickness of this swelling. Its outline is round, oval, or sinuous; and its surface, sometimes nearly smooth, is more often coarsely granulated—like that of a syphilitic condyloma—deriving this appearance from the enlarged and closely clustered papillæ. Generally, the surface is moist with an ichorous discharge; it may, however, be covered with a scab, or encrusted with a soft substance, consisting of detached epithelial scales. In most cases, the part is unduly sensitive, and injected with blood. If the papillæ become infiltrated, they constitute the *cauliflower*-like mass so characteristic of the ordinary form of epithelial cancer. (Fig. 28.) This mass looks very vascular, is moist with ichor, and covered with pasty cakes of epithelial scales, which beset the interstices of the enlarged papillæ.

(b) Occasionally, the shape of an out-growing epithelial cancer is that of a *sharply bordered circular or oval disk*, upraised a little above the level of the adjoining skin, or mucous membrane, and imbedded to about the same depth below it. The surface of this disk—usually flat or slightly concave—is granular, spongy, or irregularly cleft; and its margins are surrounded with healthy texture, which becomes raised and often slightly everted by their enlargement—*e.g.*, many epithelial cancers of the tongue.

(c) Sometimes, epithelial cancer grows out in the form of a *cone*.

(d) Lastly, the out-growing form of this disease may be a *narrow-stemmed*, and possibly pendulous, growth from the skin.

These and other shapes of superficial epithelial cancer resemble somewhat the appearances presented by warty and condylomatous growths; but they differ essentially in respect of their minute structure;—being infiltrations of the skin and papillæ with epithelial cancer-cells; whereas the structure of warty-growths remains healthy, however strange may be the appearance they assume.

2. Deep-seated epithelial cancer is generally (a) an *advanced stage* of the superficial; for by progressive infiltration, the subcutaneous or sub-mucous tissues are invaded; (b) but this variety of the disease may occur *primarily*, although comparatively rarely. “Thus,” observes Paget, “the first formation of epithelial cancer may be in masses of circumscribed infiltration of the tissues, beneath healthy skin or mucous membrane.” This condition is more frequent in the epithelial cancers that form, as recurrences of the disease, near the seats of former operations, or as secondary deposits about the borders of primary superficial growths.”

*Situation*.—Epithelial cancer selects either the skin or subcutaneous texture; or the mucous membrane; and of these textures the portions most liable are ranged by Paget in the following scale of frequency. First, its chosen seat is the *lower lip*, at or near the junction of the skin and mucous membrane; then the *prepuce* (glans, Rokitansky), *scrotum* of chimney-sweeps; the *nymphæ*, the tongue; more rarely in very many parts; as at the anus, interior of the cheek, upper lip, mucous membrane of the palate, larynx (trachea, Rokitansky), pharynx and “cardia;” neck and orifice of the uterus (stomach, Rokitansky), rectum, and urinary bladder; skin of the perineum, of the extremities; the face, head, and various parts of the trunk. In more rare instances, as a primary disease, it occurs in other than integumental parts; as in the inguinal lymphatic glands, in bones, in tissues forming the bases or walls of old ulcers. Rokitansky has met with epithelial cancer only once in a parenchyma—namely, in the liver, and then encysted in a capsule of fibro-cellular



tissue. By extension from its original seat, this growth may involve many deeper textures; fascia, muscles, bones; and as a *secondary* disease may, but very rarely, supervene in internal organs—the lungs, liver, and heart.

Epithelial cancer, as a primary disease, is usually *solitary*. Occasionally, two or more co-exist, and even in the same part, as on the prepuce and glans. Eventually, secondary epithelial cancer-growths may form in the tissues surrounding the primary and parent growth.

*Course*.—The *ulcerative* stage of epithelial cancer is that in which the disease is usually seen; and the usual state of ulceration observed is that of progressive destruction of the central and superficial parts of the cancer, with more than co-extensive growth of the marginal and deeper parts, thus constituting the type of the “cancerous ulcer.”

It is important, therefore, to be able to discern the *first* aspect of ulceration—both as regards the superficial and the deep forms of epithelial cancer, respectively; and then, the characters of the complete ulcer.

1. Ulceration of *superficial* or out-growing epithelial cancer, primarily appears as either a diffuse excoriation of the whole surface of the cancer, except its borders; or else a shallow ulcer limited at first to some fissure where the disease commenced. The discharge from this excoriated or ulcerated surface usually dries into a thin scab, or a thicker and darker crust; which conceals for a while the ravages of ulceration, still slowly extending beneath,—downwards and outwards.

2. Ulceration of *deep* epithelial cancer begins in one of three ways:—

In some cases, the superimposed skin or mucous membrane having become adherent and thin, cracks; and this condition may remain stationary for a long while, in the form of a dry dark crevice; but usually ulceration, commencing from this point, extends into the mass of the cancer.

In other cases, the substance of the cancer having become inflamed, it softens, suppurates, and discharges its contents through an ulcerated opening, or a long rent; leaving a cavity which speedily assumes the characters of an ulcer, and extends peripherally.

In a third series of cases, and, perhaps, especially in secondary formations, and in those under the scars of old injuries, the cancer protrudes through a sharply bounded ulcer in the sound integument or scar, growing exuberantly, with a soft shreddy surface, like a medullary cancer, or with a firmer, warty, or fungous mass of granulations.

Dissimilar as are the earliest aspects of ulceration in both forms of epithelial cancer,—out-growing and deep, they gradually assume an uniformity of appearance which is very characteristic.

3. *Complete Ulcer*.—An excavated sore, of a round or oval shape, presenting a roughly granular surface, which has a brick-dust red colour, and oozes a stale-smelling discharge. This surface bleeds easily, although not freely. The textures surrounding its base and borders become indurated and rigid, as they progressively become more and more infiltrated with cancer-cells. The ulcer thus acquires a remarkable degree of immobility, and its margin protrudes in the shape of a thick everted ridge, well defining the boundary of the ulcer. Infiltration increasing, the marginal ridge forms an irregular nodular belt, which overhangs the base of the ulcer and gives an undermined appearance to its everted borders. If the *papille* of the surrounding skin are more particularly the seat of cancerous infiltration, then a warty rather than a nodular belt

springs up around the ulcer. With all these signs of progressive infiltration, followed by ulceration; the work of destruction is not stayed below the *base* of the already excavated sore. It spreads deeper and deeper, sparing no texture, not even large arteries, which hold out against the invasion of most other forms of ulceration, if indeed they do escape altogether. But arteries of the first magnitude yield to the unsparing ravages of epithelial cancer.

*Affinities to Cancer.*—There are good and sufficient reasons for regarding this disease as a *variety* of Cancer. Its infiltrating character as a growth, is the essential guarantee of identity; while, its indiscriminate invasion of all textures, its ulcerative tendency, and unsparing destructiveness, corroborate the malignant nature of this growth. Then again, the lymphatic glands are early liable, although not prone, to become affected by the continued epithelial infiltration of the primary growth; but secondary formations thence arising are almost exclusively limited to glands in connexion with the immediate vicinity of the primary disease. A similar epithelial form of growth, or more commonly encephaloid cancer, may however secondarily spring up, indiscriminately in parts distant from the original disease; and there is also the less significant fact of recurrence, sooner or later, after removal by operation. Lastly, in point of hereditary influence, members of the same family, in whom either scirrhus or encephaloid cancer occurs, are peculiarly liable to the epithelial form of growth. Duly weighing all these affinities, singly and collectively, this epithelial growth is rightly denominated *epithelial cancer*. In this conclusion the most able pathologists concur; Rokitsky, Virchow, Paget, and others.

Epithelial cancer must not be confounded with the “Epithelioma” of Hannover and Bennett, who include under that title many other growths besides this variety of cancer; and it differs also from the “canceroid” of Lebert.

*Treatment.*—The guiding indications of treatment in respect to epithelial cancer, are two; one or other of which is always practicable.

(1) To superinduce inflammation and sloughing, thus destroying the cancer. This may be accomplished by caustics; such as those already mentioned for the destruction of cancer generally; the strong mineral acids, caustic alkalies, and chloride of zinc. But it must be confessed that this method of treatment is not more successful in the one case than the other. In one instance, of an encephaloid cancer of the entire circumference and nearly the whole length of the vagina, I repeatedly applied the strong fuming nitric acid by means of a glass brush; but without apparently any effect, for better or worse.

(2) Removal of the cancer is the most effectual treatment. This may be accomplished by excision, ligature, or amputation.

The former method is, generally, most eligible; care being taken to cut sufficiently wide for the entire extirpation of the growth. It will be necessary to include any neighbouring lymphatic glands which have decidedly become, secondarily, affected by the cancerous infiltration. But the strong infiltrating tendency of epithelial cancer renders its effectual removal by excision doubtful. Removal by ligature, or the eraser, is the alternative method; wherever excision is impracticable, or would be imprudent, or inefficient.

Amputation is necessary, primarily or secondarily, in certain cases. It may be so, in the first instance, owing to the extent of the disease, or

its locality, as when situated on the leg, or the arm, near the trunk. Of the latter urgency for amputation I had an instance in the case of an epithelial cancer just below the shoulder joint. [P. p. 633.] The patient died, after the operation, of Hospital gangrene. Secondary amputation is unavoidable in any case of recurrent-cancer; caustics, excision, ligature, or even primary amputation, as the case may be, having failed, perhaps successively, to extirpate the primary disease.

### CHAPTER III.

#### DEGENERATIONS.

To clearly understand the significance of the term degeneration, it is necessary to bear in mind the nature of healthy nutrition, of which physiological process, Degeneration is only another modification,—concluding the Pathology of Nutrition.

The functions of the various organs and parts of the body, in health, are so adapted or adjusted as to constitute an evenly-balanced living organization. And this co-operation is continued throughout life, in health. But the activity of all the functions—nutrition, for example—varies materially, during the successive periods of existence.

After birth and with an independent existence, during infancy, youth and adolescence to maturity; the function of nutrition is yet more one of *growth* and development. During mature manhood or womanhood, this function is simply one of *maintenance*, to repair the muscular waste of the body consequent on the functional exercise of its various members and organs. Lastly, as age approaches, and during decrepitude, the nutritive power of the body proportionately declines. Waste is still repaired; but the textural structure reproduced is an imperfect representation only, not a copy, of either its original or mature condition; it is a *retrogression* of textural structure, effected by a *degenerative* modification of nutrition. Degeneration is, therefore, only the concluding stage of the natural course of healthy nutrition, and as the concomitant retrogression of textural structure extends more or less throughout the body, and certainly pervades vital organs, the whole organism retrogrades or reverts to the unorganized matter whence it came. Earth returns to earth, ashes to ashes, dust to dust. To die by degeneration is, therefore, as natural as to live by growth and development, and by the subsequent maintenance only, of nutrition. This function is, indeed, the consummation and resultant of all the other organic functions; and when in the order of nature they decline, nutrition declines also into degeneration, which it then represents. But this ultimate modification of nutrition is sufficient for life as age advances, all other functions declining simultaneously and proportionately.

The *senile* retrogression of textural structure, thus effected, cannot, in any sense, be designated a diseased condition, nor the result of any morbid process. Nor again, when degeneration, natural to advancing and advanced life, occurs *prematurely*, can it then be regarded as a morbid process of nutrition, issuing in a diseased condition of textural structure. It is only premature old age; but the individual overtaken by degenera-



tion is the subject of *defective* nutrition, and in this sense only, retrogression of textural structure by degeneration ranks, and may be classed, with morbid products of Nutrition.

Degeneration, whether senile or premature, is a form of atrophy; but it is so by a deterioration of structural quality, not by a mere diminution of quantity. And, be it observed, this structural deterioration is effected by the relapse or falling back from a higher condition to a lower or more elementary grade of textural structure or even to an altogether structureless condition. It, moreover, takes the place of or substitutes the proper elements of the original texture, which concurrently disappear.

This *relapse* and *substitution* of textural structure, are the essential characteristics of Degenerative transformation. By substitution, it is distinguished from the transformation of texture resulting from another and widely different cause,—Disintegration.

*Causes.*—Analogy and facts alike concur to render the conclusion highly probable that degeneration, as being a modification of nutrition, is caused primarily by an appropriate blood-disease, in regard to each kind, of which it is the local and anatomical manifestation.

On the other hand—as Mr. Paget observes—degeneration, like simple atrophy of quantity may arise from local causes, and apparently the same such causes; namely, diminished supply of arterial blood, as by partial closure of the chief nutrient artery of the part; or by abrogation or suspension of function. Furthermore, both degeneration and atrophy occur commonly in old age, but possibly prematurely; both also may occur simultaneously in one and the same texture, under precisely the same conditions; and, a cause of atrophy in one case may cause degeneration in another. In relation to disease, both may concur, as in inflammation; or the disease, so called, may be only degeneration, as in simple softening of the brain or spinal-cord, and the liquefaction of inflammatory exudations during the suppurative process.

*General characters of Degeneration.*—1. The new material is of lower chemical composition;—*i.e.*, less remote from inorganic matter, than that of which it takes the place. Thus, fat is lower than any nitrogenous organic compound, and gelatine lower than albumen, and earthy matter lower than all these.

2. In structure, the degenerate part is less developed than that of which it takes the place: it is either more like inorganic matter, or less advanced beyond the form of the mere granule, or the simplest cell. Thus, the approach to crystalline form in the earthy matter of bones, and the crystals in certain old vegetable cells, are characteristic of degeneration; and so are the granules of pigment and of many granular degenerations; and the globules of oil that may replace muscular fibres or the contents of gland-cells, and the crystals of cholesterine that are often mingled with the fatty and earthy deposits.

3. In function, the part has less power in its degenerate than in its natural state.

4. In its nutrition, it is the seat of less frequent and less active change; and without capacity of growth, or of development.

*General Treatment.*—The pathological indications of treatment, in regard to degeneration, are two:—

1. To elevate the condition of degeneration to some higher state of textural structure. This indication cannot be fulfilled by any known Hygienic or Therapeutic measures. The practicability of effecting



recovery from degeneration would seem to be inconsistent with the vital incapacity of a degenerate part for growth or development.

2. To counteract any further degeneration in an already degenerate part, or its extension to texture continuous. This indication may, perhaps, be accomplished by Hygienic and Therapeutic measures, either of which are general or topical. It would appear that whatever influence, of a preventive character, any such measures may have; their action is mainly through the medium of the blood, by raising its quality and promoting its circulation.

*Hygienic* measures, of a counteractive character, are, in general, such as have reference to the functions concerned in blood-production. Diet, selected with regard to the particular form of degeneration; pure air, friction of the skin, shampooing, baths warm or cold, regular exercise, and other means of promoting excretion, are thus highly important.

*Medicinal* measures, within the present range of therapeutics, are less obviously counteractive of degeneration. Iron, cinchona bark, the mineral acids, and other tonics, may have some beneficial influence, by improving the quality of the blood and invigorating the circulation; while aperients, diaphoretics, and diuretics, increase and regulate the excretions of the bowels, skin and kidneys. Some such resources are found in convenient, and apparently inimitable combinations, in the various natural chalybeate and saline mineral waters of Vichy, Wiesbaden, and other Spas. In such resorts, persons of "a broken or worn-out constitution"—subjects of degenerative changes of structure—experience a temporary revival of their failing powers, if not a permanent restoration to health.

Rarely, any topical applications are beneficial; degeneration, of any kind, affecting internal organs, scarcely being influenced by such treatment.

*Special Kinds of Degeneration.*—Pathologists differ as to the number and specific distinctions of the various kinds of degeneration. The classification of Paget is not that of Dr. J. Hughes Bennett; nor this again, that of Dr. C. J. B. Williams.

As this branch of Pathology stands at present, I would propose the following arrangement:—(1) Fatty degeneration; (2) Pigmentary; (3) Fibrous; (4) Amyloid? Waxy, or Lardaceous; (5) Granular; (6) Calcareous, osseous, or mineral degeneration.

These various forms of degeneration are of much pathological interest to the student in Surgery, as well as in Medicine; and it is a subject upon which, respecting Fatty degeneration in particular, I have made a series of microscopic observations, both in animals and the human species. But, the distinctive structural and physical characters of each form of degeneration, and as taking place in the various normal Textures, new Products, as of Inflammation, and in Morbid Growths, are fully described in my work on "Principles;" and, as such degenerative transformations are little amenable to any special treatment—in addition to the general indications already noticed—it would be of insufficient practical importance to here re-describe them.

## CHAPTER IV.

## ULCERATION AND ULCERS, GANGRENE AND MORTIFICATION.

DEATH of any part of the body, as contrasted with its nutrition, is essentially a disintegration of the constituent elements of structure and resolution into molecular matter; the destruction of the organization which resulted from development; the falling to pieces of that which the formative power had constructed. Disintegration, like Degeneration, therefore denotes both a process and its result in the destruction of structure.

Disintegration is related to Degeneration: the latter presupposes the former, but conversely, the former does not necessarily presuppose the latter; for Disintegration may occur independently, without any preceding Degeneration of texture.

Ulceration, and Mortification including Gangrene, are essentially processes of Disintegration and textural death. But the pathology of these processes, and their difference in degree only, should be clearly understood.

ULCERATION.—A disintegrative process, essentially; the molecular matter resulting from ulceration may disappear in either of two ways:—

Firstly.—By discharge, in the liquid form; thus leaving a chasm or *ulcer*.

Secondly.—By absorption through the lymphatics and veins jointly, especially the former vessels; thus leaving a chasm or ulcer. “Ulcerative absorption” of Hunter.

Possibly, both modes of removing the disintegrated textures co-operate in ulceration.

The *evidence* in support of each such aspect of its pathology, is fully considered in the other work. [P. p. 513 *et seq.*] The balance of evidence is, I think, decidedly in favour of the removal of the disintegrated matter by discharge. This matter can, indeed, be *seen* to come away occasionally; the molecular matter accumulating in the form of minute sloughs, whenever disintegration proceeds too rapidly for its discharge in the liquid form; and again disappearing as molecular matter, when disintegration and discharge proceed evenly.

*Degeneration* precedes the disintegration consequent on inflammation; and probably, therefore, precedes ulceration. The degeneration connected with inflammation, is usually fatty. Thus, it takes place in muscles, as shown by Virchow's observations, and perhaps in muscular tissue of the involuntary order—*e.g.*, the heart, as in a case of fatal traumatic pericarditis examined by Mr. Paget; in bones, in the liver, and the kidneys, as shown also by Virchow; in the cartilages, as noticed by Redfern; and in the cornea, by Strube. Calcareous degeneration may be the prior textural change. It takes place in chronic rheumatic arthritis; with inflammation of the laryngeal cartilages; and the formation of imperfect dentine, with inflammation of the tooth-pulp, is, perhaps another illustration.

The proper discharge from an ulcer—the product of ulceration, not that of a granulating sore—is ichor, the nature of which is not well understood.

*Ichor*, is usually a thin sanious fluid, colourless or slightly yellow; structureless, but mixed with exudation, pus, and blood corpuscles, and with the disintegrated matter or *débris* of the textures. Its chemical composition, as to the essential constituents of this fluid, is unknown. Its chief property is corrosiveness; the operation of ichorous discharge maintaining and extending ulceration.

*Diagnostic Characters of Ulcers.*—An ulcer differs widely in appearance. Ulceration forms a chasm of very variable extent and depth, from the slightest abrasion of the integument to the deepest cavity down to and into the bone; it is found less frequently as such, than accompanied with granulations of some description, overspreading the whole or part of the surface. The circumferential margin of the ulcer varies in thickness, and in direction; being turned inwards and perhaps undermined, everted, irregular, or tolerably even; its colour and that of the surface may be red, dusky brown, livid, or otherwise shaded; while the ichor or discharge varies greatly in quantity and quality from the typical characters already stated, through every description of mixed discharge, or even healthy pus.

All these different appearances proceed, generally, from constitutional conditions; but, occasionally, they are produced by external causes acting locally on the part; as by friction, filth, or various topical applications and dressings.

Two classes of ulcers, therefore, each including subordinate varieties, might be recognised with reference to their pathological origin; but, practically, it may be difficult to draw this line of distinction. Hence the distinctive species and varieties of ulcers are differently enumerated by authors; the nomenclature also differing accordingly. The following species present, perhaps, the most distinctive characters:—

(1) Healthy or typical Ulcer. (2) Inflamed. (3) Irritable. (4) Œdematous. (5) Indolent, and Varicose. (6) Phagedænic. (7) Hæmorrhagic. (8) Scorbutic. (9) Scrofulous. (10) Cancerous. (11) Lupoid. (12) Syphilitic.

(1.) **HEALTHY OR TYPICAL ULCER**—consequent on a wound or other injury, or the separation of a slough; an open sore thus formed, in a healthy person and itself in a healthy state, presents certain characters, of variable extent, depth, and shape; the *surface* is uniformly mammillated with small florid granulations; which, however, do not bleed readily and are not painfully sensitive. Healthy *pus*, opaque, yellowish, and of creamy consistence, more or less in quantity, bathes this granulating surface. The *margin* of such an ulcer shelves gently down to its base, and is scarcely perceptibly harder than the adjoining healthy skin. The new skin, corresponding to the margin, has an opaque white colour, and its formation is preceded by a linear translucent film of cuticle, which, veiling the subjacent granulations, has a bluish-white tint. The granulations immediately within this line are more florid than those nearer to the centre of the ulcer, because more vascular where the cuticle and skin circumferentially, are being formed.

The surface having reached the level of the skin, by granulation, and the formation of pus,—superfluous organizable material,—having ceased; cicatrization proceeds inwards by the continued formation of marginal



skin, preceded by cuticle, and thus, at length, presents the characters of healthy cicatrix, in the recent state. [See Reparation by Granulation.]

*Treatment.*—Little or no positive treatment is requisite, a healthy ulcer healing spontaneously, provided any circumstances adverse to the process of reparation be excluded. Rest, position, to prevent tension and any undue determination of blood, and protection of the surface by water-dressing; are sufficient.

(2.) INFLAMED ULCER.—A departure from the healthy type of ulcer; the usual signs of inflammation are characteristic. An area of redness with some swelling around the ulcer are more or less conspicuous appearances; while a burning heat and aching pain are experienced, particularly when the part is pendent, as the shin, a common situation for an inflamed ulcer. The granulations have a rose-red rather than a florid colour, or they may be absent and the surface of the ulcer overspread with a thin ash-grey slough; the suppuration is scanty, thin, and perhaps tinged with blood. As inflammation subsides, the cuticle peels off or desquamates for some distance around the ulcer.

This condition of sore accompanies inflammatory fever, an ulcer previously healthy then becoming inflamed; or it may be produced by external violence or consequent on local irritation.

*Treatment.*—Any cause or causes in operation will, as usual, primarily direct the treatment, namely, their removal. Then, remedial measures are those appropriate for inflammation. A poultice, or a cold evaporating lotion, if more agreeable, and perhaps the local abstraction of blood by a few leeches applied in the neighbourhood of the ulcer; with rest and an elevated position of the part, and, finally water-dressing as the sore assumes a healthy character and undergoes the process of healing. Bandaging the limb, may, at this period, be useful to support the weakened vessels of the part, and thus prevent any liability to the continuance or recurrence of a low state of inflammation; a very troublesome chronic condition, which is apt to follow an acutely inflamed ulcer.

(3.) IRRITABLE ULCER.—This variety of ulcer is to be distinguished from an inflamed ulcer, with which it might be confounded. Painful to a degree, even of a neuralgic character, the other and more peculiar signs of inflammation, particularly circumferential redness and swelling, are wanting. The granulations are imperfect, or absent, reddish here, tawny there; but they are very painful and sensitive to the touch, and readily bleed on slight pressure or the application of a stimulant dressing. The discharge is thin and sanious; and the edge of the ulcer, irregular, sharp, and abrupt, evincing no disposition—not to say an obstinate indisposition—to commence cicatrization.

Commonly situated on the shin or lower part of the leg; an irritable sore or fissure of the anus not unfrequently occurs, which well illustrates the pain and other characters of this variety of ulcer. It is generally connected with some disturbance of the digestive organs, and with constitutional irritation as distinguished from inflammatory fever. More rarely, some cause of local irritation may co-operate: as the passage of the fæces and the contraction of the sphincter-ani muscle with regard to irritable ulcer in ano.

*Treatment.*—The removal of any cause in operation is the primary consideration. Hence the rectification of the constitutional disorder, by saline purgatives and mercurials to influence the secretion of bile. Then, opiates occasionally, will do much to allay the general irritability. Of topical



applications, nitrate of silver freely applied is the most efficacious. Lead and opiate lotions may also be recommended. Rest of the part is necessary or advantageous, as in the treatment of other ulcers; and thus, division of the sphincter-ani muscle by incision through a fissure of the anus, will relieve pain and facilitate granulation in that situation. In any case of irritable ulcer, as healthy granulations spring up, the pain subsides; and the cicatrix formed is not more than ordinarily sensitive.

(4.) EDEMATOUS ULCER.—In this variety of ulcer, the granulations are large, pale, translucent and flabby, sometimes cropping-up as large gelatinous masses above the level of the sore. The discharge is watery, and the margin has no disposition to commence cicatrization. Indeed, the granulations are apt to slough. This condition arises in connexion with a weak circulation, or it may proceed from the soddening of an ulcer by continued poulticing or other prolonged application of moisture and warmth.

*Treatment.*—In addition to the removal of any constitutional or local cause; local treatment is often remarkably curative. An elevated position, astringent lotions, as of sulphate of zinc or nitrate of silver, and the support of a bandage; will probably succeed in reducing the granulations to the level of the ulcer, when exuberant, and strengthen their vitality, thus favouring cicatrization.

(5.) INDOLENT, AND VARICOSE ULCER.—A deep and, perhaps, large excavation, presenting a flat surface,—without granulations, of a dusky or pale colour, scarcely sensitive to the touch nor disposed to bleed, and having a firm, hard base adherent to the subjacent fascia. A thin offensive discharge exudes. The edges are everted, thick, and callous, and of an opaque-white colour,—owing to accumulated epidermis; the surrounding integument to some distance being congested, of a dusky hue, and pigment stained, thickened, hardened, and bound down to the textures beneath. Such an ulcer is obstinately indisposed to heal. It is commonly situated on some part of the leg.

An ordinary—non-specific—indolent ulcer does not seem to be dependent on any constitutional disorder; but it is apt to occur in weakly, ill-nourished, and perhaps ill-fed persons.

The *varicose* ulcer, is a variety of indolent ulcer, and so named from its connexion with a varicose condition of the adjoining veins. Resembling generally an ordinary indolent ulcer, it differs in certain tolerably distinctive characters. Situated on some part of the leg, commonly on the inner side towards the ankle, and single; in the recent state it is of small size, ovoid shape, and with its long axis in the direction of the limb: without granulations and firm, a bluish-purple colour of the base and more so of the margin and surrounding integument, is conspicuous, and the ulcer is not unfrequently painful and sensitive. Inflammation and sloughing, or other conditions, may temporarily veil these appearances; but the tortuous, knotty enlargement of the venous trunks, or the more diffused mottling of smaller varicose veins, with, perchance, a brownish-red pigment stained skin around the ulcer, is still a characteristic accompaniment. In the progress of varicose ulcer, an occasional event of practical importance is venous hæmorrhage; arising from the ulceration having penetrated an enlarged vein, it may occur suddenly and copiously.

*Treatment.*—An indolent ulcer cannot cicatrize so long as it and the surrounding integument are both bound down; the margin being upraised and retracted, and the base depressed. Accordingly, pressure

and stimulation conjoined, represent the plan of treatment. The nitrate of silver freely applied to, and around the ulcer, or the continued application of zinc ointment, with tolerably firm bandaging may bring it into a healthy condition. A more even and constant pressure is secured by strapping the limb with strips of linen spread with soap-plaster, mixed with a little adhesive plaster to fix it. Drawn around the limb, from the side opposite the sore, each strip in succession should partly overlap the preceding one, and the ends be crossed obliquely; thus forming a compact caseament, and which should extend two or three inches above and below the sore.

Blistering circumferentially, softens and loosens the integument, and may thus tend to facilitate cicatrization. Incisions have been recommended to allow the granulations to contract; and, in most obstinate cases, transplantation of a portion of adjoining healthy integument, sufficient to close in the ulcer, may be tried; with the view of forming a substitute-cicatrix. Of these three resources, I am decidedly in favour of blistering.

Opium seems to have some special influence in rendering the granulations florid, and promoting the healing of an indolent ulcer. It is therefore, advisable to keep the system under this influence by the repeated administration of opium, in small doses. Stimulants, tonics, and a generous diet, will often prove beneficial.

The *varicose* ulcer is amenable to the same plan of treatment; but the varicose state of the veins, as the cause in operation, is an additional and the special object of treatment. An elevated position of the limb to relieve congestion, and an elastic bandage or stocking to equally support the vessels, will prove sufficient for this purpose, in most instances. When the ulcer has healed, it may still be necessary to wear an elastic stocking, as a preventive measure. In more obstinate cases, and with the view of a *permanent* cure; obliteration of the larger veins may be resorted to. Of the many means devised, the safest and most successful, in my experience, is the following:—A hare-lip pin is passed underneath the vein, and another at a point about an inch distant. Care must be taken that the vessel be not transfixed, a misadventure easily avoided by dipping the pin, and readily discovered by the escape of a drop or two of venous blood. If the vein be transfixed, the pin should be withdrawn and introduced at another point. A ligature passed round either pin in a figure of eight fashion, will compress the vessel sufficiently to cut off all communication with the venous blood in either direction, and thus isolate the portion of vessel between the pins. Division of the vessel in that situation subcutaneously, as recommended by Mr. Lee, will then more thoroughly ensure its obliteration. (See VEINS.) Several such interceptions may be necessary at different points in the course of the saphena vein; in which case the highest pair of pins should be introduced first. The pins must be allowed to remain for about a week. I do not find the tendency to slight ulceration of sufficient importance to require the precaution generally recommended, that of protecting the vein with a piece of bougie before applying the ligature. After this operation, in no case have I seen any perilous consequence, such as phlebitis or pyæmia, but diffuse or erysipelatous inflammation ensued for a while, in one case. In some instances, after the lapse of a year and a half or two years, occlusion of the vein has still been complete, a permanently successful result which has allowed of active exercise with comfort; in other cases, the

varicose condition has returned, as the only unfavourable issue; while in yet a few, it has remained on the removal of the pins, and a repetition of the operation has altogether failed.

Venous hæmorrhage, occurring in the course of a varicose ulcer, may be arrested by a compress of lint, secured by a bandage, over the aperture in the vein which has given way; and by elevation of the limb.

(6.) PHAGEDÆNIC ULCER.—Essentially a spreading ulcer, it is characterized by dusky red discoloration and swelling, with perhaps acute pain around the ulcer; a grayish, glutinous or slimy slough, which exhales a peculiar fætid odour, occupies the surface of the sore, and the edges, sharp, irregular as if worm-eaten, and undermined, fall away rapidly; thus enlarging and deepening the area of the ulcer. Sloughing may predominate in such ulceration, and hence sloughing and phagedænic ulcers are not uncommonly associated.

Sooner or later, constitutional disorder ensues; irritation rather than inflammatory fever, with great weakness and exhaustion.

Allied as this condition is, in its local and constitutional characters, to Hospital gangrene; it would seem that such gangrene arises from an external cause,—contagious matter applied to a sore; the constitutional disorder being secondary and symptomatic, although in its turn affecting the ulcer. On the other hand, habitual deprivation of food, the abuse of stimulants, or living on spirits, and, perhaps, overcrowding, with destitution; seem to give rise to phagedæna.

*Treatment.*—To arrest the rapidly spreading ulceration, a free application of strong nitric acid, by means of a glass brush, is most effectual. Followed by poultices, the slough, thus formed, is detached, exposing probably a healthy surface, which has acquired a healing character. Re-application of the acid may be necessary, or the continued application of yeast, charcoal, or chlorinated poultices may be sufficiently stimulant and cleansing; and, at the same time, disinfectant. Opium, administered in small and repeated doses, so as to keep the system under its influence, is most potent in allaying the irritative fever; while the strength of the circulation and healthy nutrition, are restored by quinine, the mineral acids, and a generally nourishing diet.

(7.) HÆMORRHAGIC ULCER.—Any variety of ulcer may assume this character, but some more particularly—*e.g.*, the irritable, phagedænic, varicose, cancerous, and, perhaps, lupoid ulcers. by the penetration of a blood-vessel; and the scorbutic ulcer, by passive hæmorrhage owing to the blood-condition. Not unfrequently, an ulcer oozes blood about the catamenial period, and especially in women suffering from amenorrhœa; the hæmorrhage then being vicarious menstruation. An ulcer thus acquires a bloody, clotted appearance.

*Treatment.*—Arising from such various causes, an hæmorrhagic ulcer is a contingency rather than any special variety of ulcer,—and should be treated accordingly in connexion with whatever ulcer it may be associated; by reference to the particular condition, local or constitutional, which causes the hæmorrhagic character.

(8.) SCORBUTIC ULCER.—Although scurvy in itself—observes Mr. Busk—cannot be said to be attended with any peculiar form of ulceration, ulcers or sores of any kind already existing from other causes assume, in consequence of the scorbutic taint, a more or less peculiar character, and when thus modified have usually been termed “scorbutic ulcers.” It is the



effusion of a semi-plastic fibrous material—the same as that which causes the spongy swelling of the gums, &c.—on the free surface of sores or ulcers, which gives them the peculiar aspect termed scorbutic. Ulcers of this kind are distinguished by their livid colour, irregular tumid border, around which no trace of cicatrization is evident; whilst the surface of the sore is covered with a spongy, dark-coloured, strongly adherent, fœtid crust, whose removal is attended with free bleeding, and is followed by a rapid reproduction of the same material. This crust, in bad cases, as remarked by Lind, attains to a “monstrous size,” and constitutes what has been appropriately named by sailors “bullock’s liver.”

*Treatment.*—Regarding a scorbutic ulcer as but a manifestation of the blood-disease—scurvy, the appropriate treatment is that which pertains to this disease; and having regard to its apparent dietetic cause, namely, the deprivation of fresh vegetables, remedial measures will consist, chiefly, in their restoration. Hence the well known efficacy, preventive and curative, of potatoes and of lemon or lime-juice.

(9.) SCROFULOUS OR STRUMOUS ULCERS.—Consequent on the ulceration of a scrofulous tubercular swelling, or the opening of a scrofulous abscess, the ulcer is remarkably indolent, yet its characters are unlike those of the ordinary indolent ulcer. Large, pale, flabby granulations, sometimes exuberant, with a gleet discharge, form the surface of the sore; the margin is thin, livid, and undermined, sometimes pretending to heal by encrustation of the discharge. The characters and tendency are those of an ordinary œdematous ulcer; but a scrofulous ulcer is even less disposed to heal *soundly*. A scrofulous cicatrix appears drawn, puckered, and incomplete. Small bridges form across the ulcer, underneath which a probe can be passed readily, in and out, here and there. Nature does but “skin and film the ulcerous spot.” The co-existence of scrofulous swellings and abscess, in other parts, will complete the diagnosis.

Such ulcers are most frequent in the neck, groins, cheeks, scalp; and about the knee, ankle, wrist, and elbow. They are often numerous and clustered.

The immediate cause in operation would appear to be a blood-disease, the nature of which however is unknown. But whatever impairs the nutritive qualities of the blood and its circulation, predisposes to scrofula. Hence deficient or defective food, insufficient ventilation, want of cleanliness and excretion, poor clothing, cold, damp, and even dark localities, with other hygienic conditions of similar import, are the nurseries and nurses of this blood-disease. Individual predisposition, as usual, plays its part; for among a family of children in precisely the same hygienic circumstances, one becomes scrofulous, while the rest remain free.

*Treatment.*—In addition to the removal of any adverse hygienic condition; iron, bark, and cod-liver oil, are calculated to strengthen the circulation and improve nutrition. The digestive organs will also require watchful attention. A stimulating plan of treatment with moderate pressure on the ulcer is appropriate, as for an œdematous ulcer. Thus, nitrate of silver or sulphate of copper, and bandaging, are beneficial as topical appliances; but the more important part of the treatment is constitutional.

The scar of a strumous ulcer is unsightly and may occasion deformity, either by contraction or, more commonly, by over-growth, and the formation of bars raised in radiating lines, or net-works, or tongues of skin. In such cases—observes Mr. Paget—excision of the scar may be



necessary ; but in many instances a great portion of the excess of scar can be removed by repeated slight blistering, and with time nearly the whole will level down.

In a superficial scrofulous ulcer on the hands or feet, excessive growth of the *papilla* at the base or borders of the ulcer, gives a remarkably warty character to the ulcer ; which often remaining after cicatrization, leaves a coarse, nodular, patch of skin, with opaque, thick cuticle. In this particular resembling a papillary epithelial cancer ; the diagnosis of this form of scrofulous ulcer may be determined, by the absence of hardness in the granulations or the base, of a sinuous or upraised border, and of rapidity of progress ; and by the presence of more than one, perhaps many such ulcers.

These warty strumous affections may be cured by repeated applications of iodine-paint.

(10.) **CANCEROUS ULCER.**—Already described in this work, as part of the general history of cancer ; the characters of a cancerous ulcer are here alluded to as compared with those of a lupoid ulcer. The scirrhus ulcer is most distinctive. Beginning in the skin and extending down to deeper textures, or commencing subcutaneously—in a cancerous mass, and extending upwards to and involving the skin ; the ulcer formed in either way, presents an irregular cavity, the surface of which is covered with large, hard granulations, discharging a thin, peculiar smelling ichor ; the edges are elevated, thick, and everted, with much circumferential induration. The neighbouring lymphatic glands are, or become, indurated, and enlarged. The ravages of this ulcer are unlimited.

*Treatment*—see **CANCER**.

(11.) **LUPOID ULCER.**—Commencing as a fissure or soft wart ; the ulcer formed is an excavated hollow, having, commonly, no granulations, the edges sharp and worm-eaten, with no induration around. The lymphatic glands are unaffected. But this ulcer, also, spreads and spares no texture.

As contrasted with a cancerous ulcer, the differential characters, above stated, were early impressed on my mind by two well marked cases which I observed when a student at the University College Hospital. The one, an elderly woman—under the care of Mr. Morton—had a large cancerous ulcer of the leg, which presented the appearances I have described ; the other, a middle aged man, an ostler,—under the care of Mr. Liston—had a large lupoid ulcer of the cheek, with the appearances already noticed,—namely opposite to those of a cancerous ulcer.

*Treatment.*—Various powerful escharotics have been tried with the view of arresting the progress of a lupoid ulcer, and converting it into a healing condition. Chloride of zinc, mixed with flour and forming a paste by deliquescence, was used in Mr. Liston's case. The intense pain, for a time, which followed its application, would now-a-days be subdued by the continued influence of chloroform. Subsequently, poultices, help to bring away the slough. Further extension of the ulcer may be thus arrested, and the cavity evince a tendency at least, to heal. This favourable change took place in the case alluded to, and I have since met with similar instances. Iron, bark, and cod-liver oil, and other means of improving nutrition, seem to have some beneficial influence.

(12.) **SYPHILITIC ULCER.**—Primary, secondary, and tertiary syphilitic ulcers form part of the general pathology of Syphilis.

**MORTIFICATION.**—The transition of ulceration to mortification, as already noticed, will have suggested their mutual relation. As processes,

they differ in degree, but are one in kind. The former may be exaggerated into the latter, and this again may subside into that. Ulceration and mortification are convertible by gradations of the same process, disintegration of structure; the one, molecular, as a liquid discharge; the other *en masse*, presenting accumulations of disintegrated matter. Thus, during ulceration, ever and anon some temporary cause may accelerate the process; a larger portion of tissue undergoes disintegration than can concurrently pass away as discharge; a portion of such matter then appears as slough, instead of having disappeared imperceptibly—molecule after molecule—in ichorous solution. It is as if the “flow” of a tidal stream washed up more material than the returning “ebb” can well recover—the line of coast shows the remaining débris. Even so, the surface of an ulcer may present a rim of slough, and from time to time, another and another, as the margin of the sore recedes and extends.

*Signs.*—*Gangrene*, or the incipient stage of mortification, exhibits certain characteristic appearances. (Fig. 29.) The skin is livid or has a black hue, shading off to a reddish brown around the dying part. Its consistence is changed; becoming soft, with considerable swelling and

FIG. 29.



pitting on pressure, while the cuticle is raised into vesicles containing a yellowish serum or, phlyctenæ—large bladders, full of bloody serum. The part is, in fact, altogether sodden and succulent, from the infiltration of

FIG. 30.



the constituent cellular texture with serum. This condition is the *humid* gangrene of French authors, the *hot* of German writers, and the *acute* of our own school. (Fig. 29.) Or the part may be hard, shrunken, and dry. An

opposite condition, known as *dry, cold, or chronic gangrene*. (Fig. 30.) In either state, the sensibility of the part is diminished, and its temperature reduced. The odour of gangrene is peculiar and pungent; it becomes fœtid with the evolution of gas by decomposition, which, inflating the cellular texture, much increases the swelling; and owing to the admixture of gas and serum, it then has the additional character of crackling under gentle pressure, or of fluctuation like a collection of pus, if the deeper textures be thus distended. The part is irrecoverably dead; mortification having advanced to its second and furthest stage—the condition of *sphacelus*. The textures, in this condition also, may be dry and shrunk; as in senile gangrene which has advanced to sphacelus. In either case the part is insensible and cold.

The anatomical condition of sphacelus is somewhat peculiar. Disintegration of the soft textures still prevails; the bones, indeed, may have undergone but little change, otherwise than appearing dry and bloodless, their periosteum being detached; but the articular cartilages and tendons are dull and slightly softened, while all the softer textures have broken down indiscriminately, with one exception. The bloodvessels alone have escaped destruction. Thus, phlegmonous erysipelas may have laid bare several inches of the femoral artery, by sphacelus of the integuments, and yet that vessel remain intact. The blood also—stagnant and coagulated therein, after death—may remain fluid and circulating during life; or coagulation having taken place the vessel will be impervious, and perhaps to some distance above the seat of sphacelus. Hence the absence of hæmorrhage during amputation in such cases.

CAUSES—*external and internal; and their operation*.—The pathology of ulceration and mortification being essentially the same, their etiology also is the same.

*External agents*: physical—as mechanical violence and injury, heat, cold, electricity; chemical decomposing agents; and vital, as animal poisons introduced into any living texture. Either of these external causes may *immediately* kill the part, or kill, if the tissue be vascular, by *inflammation* supervening and terminating, perhaps speedily, in mortification.

(1.) Violence or injury of any kind may give rise to gangrene, which is thence denominated *traumatic*. It is thus distinguished from gangrene arising from any internal, and commonly constitutional disease—*e.g.*, a blood-condition; and which, as a local manifestation of that disease, is thence denominated *idiopathic* gangrene. This distinction is noticed more particularly, in connexion with contusion and contused wounds.

Of traumatic causes, pressure, or contusion, *directly* applied, severely although momentarily, as by a squeeze, kills the part immediately. A finger caught in the hinge of a door may thus be squeezed to death. Or, pressure, continued, although less severe, excites gangrenous inflammation. In either case, mortification is limited to the part injured. *Indirect* contusion or concussion, as by a fall, may not be more severe, and is certainly a momentary cause; but it produces gangrene or gangrenous inflammation; and the mortification will be more extensive, although still co-extensive only with the part injured.

Pressure or contusion—directly or indirectly—chiefly injures the capillary vessels and smaller arteries; but traumatic gangrene more frequently arises from injury to *larger-sized* blood-vessels. Considerable hæmorrhage takes place, causing gangrene, partly by pressure of the



blood extravasated among the textures, partly or principally by cessation of the supply of blood requisite for nutrition.

Wounds implicating the larger blood-vessels, compound fracture, and dislocation; especially operate in this way. Gangrene is not necessarily limited to the immediate and apparent seat of injury; it may extend—*e.g.*, up a whole limb, but still only as high as the cause in operation. Heat, cold, and electricity, require no further consideration as *causes* of mortification, than that they operate, either by killing outright, or by inducing gangrenous inflammation; cold, however, not seeming to have the power of killing a part at once. A frost-bitten or frozen portion of the body is not irrecoverably dead.

(2.) Chemical decomposing agents, on the other hand, mostly operate by killing immediately—decomposing the living tissues with which they come in contact. Such are caustic alkalies, the concentrated mineral acids, and other escharotics.

(3.) Animal poisons introduced into the body, are generally less immediately killing to the part—*i.e.*, they induce gangrenous inflammation. Bites of venomous serpents represent this class.

*Internal* causes are perversions of the constituent elements of nutrition. Blood of a certain “quality,” suitable to each part for its nourishment, and a certain “quantity” of this blood supplied to and circulated through the part; “an appropriate physical and structural condition of the part itself;” and, some kind of “nervous influence;”—these are the internal conditions, which, when perverted, become internal causes of mortification.

(1.) *Blood-conditions*, by alterations of *quality*, are eminently constitutional causes. Their pathological nature is but little understood; their local manifestations in gangrene, having characteristic appearances, are well known. Some of these blood-conditions were alluded to, in speaking of the varieties of ulcers as depending on constitutional causes. Other such causes more especially give rise to mortification, in various remarkable forms. Thus are produced carbuncle, boil, and the carbuncle of plague; phlegmonous erysipelas, bloody small-pox, malignant scarlatina, glanders, ergotism, scorbutic sloughing, the phagedænic and sloughing buboes of syphilis.

Mortification arising from any blood-disease spreads without limitation, as to its extent.

(2.) The *quantity* of blood supplied to and circulated through any part, depends upon and is regulated by the heart’s mechanism and action, the state of the blood-vascular system—arteries, veins, and capillaries, and the physical condition of the blood itself, chiefly in respect of its spissitude and adhesiveness. These conditions are severally, and collectively, more or less causes of mortification.

Of diseases and malformations of the *heart*, their influence in relation to mortification is impressively illustrated by the following case, which is, I believe, *unique*.

A boy, aged fifteen, came to the Royal Free Hospital, as an out-patient, with bluish-black congestion of the toes of both feet, as high as the instep, and thence shading off in a dusky hue up the legs. The whole surface of the body, was more or less livid, especially the cheeks and lips. The weather was cold, and he had been exposed, with scanty clothing, and had undergone deprivation. But, the circulation was naturally feeble, the bluish, almost cyanotic appearance having been noticed



from birth by those who knew the boy; his expression was anxious and prematurely aged, his manner deliberate and lethargic, and his breathing short and oppressed. After being twenty-four hours in bed, under the cautious administration of stimulants, brandy and ammonia, with hot bottles to the feet, which were wrapped in cotton-wool, the general circulation had somewhat returned; but the congestion of the toes had passed into gangrene, sphacelus speedily ensued, and one or two dropped off. I amputated both feet through the tarsal bones; union in part primary, in part by granulation, took place, forming two capital stumps. Recurring attacks of dyspnœa and lividity proved fatal in a month after operation. Post-mortem examination showed that the immediate cause of death was acute pericarditis and pleurisy. But the heart was much enlarged, its right half extending outwards to the junction of the ribs and costal cartilages.\*

(a) *Arteries* are liable to undergo changes of structure, which are particularly worthy of notice surgically.

*Ossification* or calcareous degeneration of the larger arteries with fibrous thickening of the smaller ones, accompanied, possibly, with some contraction of the vessels; lead to coagulation of the blood in tubes which have thus become too rigid for the transmission of that fluid, in quantity adequate to meet varying demands. This condition represents the changes of structure concerned in producing "senile" gangrene,—a dry form of mortification, commonly affecting the foot, when the arteries of the leg have undergone these changes. Some slight injury, followed by low inflammation, is usually the immediate or exciting cause in such cases. Traumatic gangrenous inflammation, is in fact, engrafted on the state of the arteries,—as a predisposing condition. Mortification, commencing generally in a part most distant from the heart, as the ball of the great toe, and thence spreading upwards, gradually assumes the appearance of a black slipper on the foot.

*Arteritis*,—inflammation of an artery—is a far less frequent cause; it acts in a similar manner, and may induce gangrene of the same character, or more dry and horny.

*Fibrinous coagulum*, not formed in the artery where it is found impacted, but washed from the left ventricle of the heart and carried thence by the current of blood to that vessel; is another cause of gangrene, perhaps merely an occasional one, but the pathology of this condition has only recently been investigated. An artery thus impacted with a clot, is known as "embolism."

*Rupture* of the internal and middle coats of a large artery, by violence, may induce coagulation; the loose portion folding inward across the stream of blood. Mortification is liable to supervene.

*Aneurism* is another cause; partly by interrupting the free flow of arterial blood through the aneurismal artery, and partly, by pressure on adjacent veins, obstructing the return of venous blood. Popliteal aneurism will thus induce gangrene, which soon passes into sphacelus.

*Wound* of a main artery acts in two ways. A punctured wound may be an immediate cause, by loss of blood. A contusion or bruise may lead to sloughing of the vessel, after some days have elapsed; this being attended with hæmorrhage and false aneurism, followed by mortification. Laceration of the vessel may, in like manner, have the same issue. In

\* Examination not concluded on going to press.

either case, the integuments may have escaped injury. Simple fracture, and perhaps, simple dislocations, will thus lead to mortification, occasionally. Compound fracture and dislocation, far more frequently.

It is highly important to observe the *partial extent* to which gangrene is liable to spread, in connexion with all these vascular lesions, as contrasted with gangrene arising from any constitutional cause. Unlimited in that case, it is here limited in extent to the *source* of gangrene, and probably restricted to less than that extent, by the enlargement of branches coming from the artery above the seat of injury, which supply a collateral and compensatory circulation of blood. Thus limited is the gangrene arising from the ossification of arteries or senile gangrene; from arteritis; from embolism; from partial rupture of an artery; from aneurism; and from wounds of an artery, whether punctured, contused, or lacerated. But, then, the limitation connected with *some* of these causes,—the point to which gangrene may extend—can scarcely be determined during life. This is the practical ground of distinction between senile gangrene, arising from *ossification* of the arterial vessels, and *traumatic* gangrene; and in favour of the latter, the limitation of which can be more definitely *predicated*. Failing this fore-knowledge, the Surgeon must wait the “line of demarcation,” drawn by nature.

(b) *Veins* are less liable to become causes of mortification; obstruction to the return of venous blood from any part of the body, having a less important relation in this respect, than obstruction to the supply of arterial blood.

*Phlebitis* induces coagulation of blood within the vein or veins inflamed, and this obstruction is attended with œdematous swelling of the limb or part below. The swelling becoming tense and persistent, is a condition bordering on gangrene. *Phlegmasia dolens*, in which the iliac and femoral veins, the main venous trunks of the limb are inflamed; thus perils the leg below.

*Fibrous obliteration* of a venous trunk is another such cause, once in a way, of tense anasarca.

*Phleboliths* or vein-stones, not unfrequently formed within various veins, more particularly the iliac, have a similar tendency.

*Aneurismal varix* and *varicose aneurism*, resulting from a communication between an artery and a companion vein, as from unskilful venesection at the bend of the elbow; is attended with venous engorgement, persistent, and increasing, and œdematous swelling of the limb below, threatening gangrene.

*Prolonged pressure* on a large vein, itself in a healthy state, is an extraneous cause of obstruction to the return of venous blood. Tumours, and tight bandaging, may thus, indirectly, have this effect in relation to mortification.

The *limitation* of gangrene is no less characteristic of that which arises from obstruction in the course of a large vein, than from obstruction of a main artery; the gangrene, in either case, extending possibly up to, and probably within, that situation.

Thus *both* classes of causes, those pertaining to the arteries and those pertaining to the veins, concur; and differ from any constitutional cause, in relation to gangrene.

The limitation also dependent on *some* venous causes, like that dependent on certain arterial causes, can scarcely be *foreseen*. *Diseased* conditions of veins are more often perplexing in this respect, as compared

with any tendency to gangrene of *traumatic* origin from injury to a large vein.

(c) *Capillaries*.—*Compression* of these vessels is followed by gangrene of the part, if thereby deprived of a due supply of blood.

*Inflammation*, therefore, with lymph-production, and compression of the capillary vessels, reacts destructively upon the textures. Moreover, inflammatory products, for the most part, are inherently short-lived. And especially during suppuration, the surrounding textures are dying, disintegrating, and being absorbed to make room for the new product—pus; destruction and production here usually keeping pace. Hence the formation of *abscess* necessarily pre-supposes the death and absorption of the textures around; and co-extensively with the formation of pus, which now occupies their place. Sometimes, they die faster than absorption can remove them, and then their mortification—as sloughing of the soft textures or a sequestrum of dead bone—becomes plainly visible.

Certain conditions *predispose* to gangrenous inflammation. Blood-poisons are constitutional causes of this kind; as in the production of carbuncle and boil, phlegmonous erysipelas, and the other forms of gangrenous inflammation, already mentioned in connexion with the constitutional causes of mortification. Intensity of inflammation has a similar tendency. And lastly, the vascularity of the texture affected; a comparatively avascular tissue readily becoming gangrenous, and especially if looseness of texture permit the accumulation of serum; as the cellular tissue, in erysipelas, and any texture under the pressure of effusion beneath an unyielding investment, as the tendinous expansion of the occipito-frontalis muscle.

(3) *Physical and structural* conditions of the part in relation to mortification generally.

Of physical properties; an *unyielding fascia* or aponeurosis—*e.g.*, the fascia lata, predisposes subjacent textures to gangrene, by pressure in the event of any effusion of blood or serum therein. *Looseness* of texture also predisposes to this issue, by favouring an interstitial accumulation of blood or serum. Traumatic gangrene is determined, partly by these physical conditions, impeding the nutrition of the part; although mainly, by the insufficient circulation of blood, depriving it of adequate nourishment, and by the damage which the textures have directly, or indirectly, sustained by violence. Structural conditions predispose to mortification; the proportion of blood-vessels having this relation. Both extremes meet—comparatively *avascular* textures have a tendency to gangrene; *e.g.*, the liability of cellular texture to slough, from any cause. Highly *vascular* textures also have a similar tendency, apparently by favouring the intensity of inflammation and effusion; *e.g.*, the skin as compared with fibrous or tendinous textures, which often resist sloughing long after the integument has disappeared in consequence of an extensive burn.

Predisposition to gangrene from textural conditions, is most conspicuous when they are *co-operative* causes. Cellular texture for example, being comparatively avascular, as well as liable by its looseness to become the seat of interstitial effusions, most readily sloughs.

*Causes of Ulceration*.—By some variation in the *degree* of any cause of Mortification, this process of mass-disintegration subsides into that of molecular disintegration. Ulceration is mortification by small instalments. Consequently, similar conditions of texture *predispose* thereto. Thus, with regard to vascularity; the less vascular textures are prone to



ulcerate, as well as mortify,—*e.g.*, cellular-texture, and cicatrix-tissue; in this respect agreeing with the liability of the highly vascular skin, and mucous membrane, to inflammation and thence to ulceration.

The comparative liability of different textures to ulceration and mortification, is well shown in the natural process by which a dead limb is gradually separated from the living tissues; they detaching themselves from the dead. All, excepting the cellular texture and tendons, are severed by ulceration forming a fissure, which is progressively incisive down to and through the bone. The dead skin, vessels, muscular tissue, and bone are severally detached evenly, by ulceration; but the cellular texture and tendons die for some distance upwards within the stump, and are detached irregularly, by sloughing.

(4) *Nervous influence*, of some kind, plays an important part in mortification and ulceration. For example; injury to the spine has been followed within twenty-four hours by mortification of the ankle; and the tendency to ulceration in such a case, or of the cornea in connexion with facial paralysis, is equally remarkable.

Considering the whole etiology of mortification and ulceration practically, the most important general fact is the *co-operation*, usually, of two or more causes, in either mode of death; whereby it is difficult to determine the share due to each internal condition, more especially in conjunction with the operation of external circumstances, such as moisture, temperature, etc.

*The Fever of Mortification*.—Coincident with mortification, as the local disorganization, the constitutional disorder at once commences. Its phenomena or symptoms, are generally more insidious, but not unlike those of Pyæmia, though differing in degree. A wild apprehensive look, with great restlessness, are conspicuous; the features and manner at length become somewhat composed, and the face assumes a pallid hue. In some cases, the tunica conjunctivæ, and the skin over the whole body, acquire a peculiar yellow colour. Utter prostration of mind and muscular power gradually supervenes, and a quivering subsultus tendinum steals over the patient. The pulse is now very feeble, rapid, and irregular, feeling like a fine rough wire drawn under the finger, and perhaps scarcely to be distinguished from the vibrating *subsultus* of the adjoining tendons. The secretions are soon perverted. The skin, at first hot and dry, is afterwards bathed with a cold, clammy sweat. The urine, fœtid and scanty, may be suppressed. A brown, rough, dry tongue with black sordes encrusting the lips, are accompanied with nausea and a putrid diarrhœa. The powers of organic and of animal life failing, involuntary excito-motions prevail; spasms and convulsions shake the moribund body, while coma ends in death.

Or, the mortification ceases to spread. The reddish brown tint of the skin bordering the dead part, and which has hitherto spread in advance, gets brighter and more circumscribed. A white raised line—the “line of demarcation”—forms in the living skin immediately adjoining the dead; it melts into a groove by ulceration, which extending deeper and deeper, as a fissure, successively passes through tissue after tissue, and at length converging, thus completely detaches the whole of the dead part. Pending this course of severation from the living organism, adhesive inflammation precedes the line of ulceration, and, corresponding to it in length and depth, seals the blood-vessels; thus effectually excluding any further communication with the dead tissues and preventing their absorp-



tion for the time to come. The typhoid fever immediately begins to subside, and ultimately ceases. In exchange, some degree of "inflammatory fever" accompanies the concurrent process of ulcerative separation and reparative adhesion.

Such is a descriptive outline of the origin, course, and termination, fatal or favourable, of the constitutional disorder proceeding from mortification. Arising with spreading gangrene, it ceases when the dead part is detached from the living body. Respecting the obvious dependence of this fever on mortification; these two general facts, taken conjointly, seem to warrant the conclusion, that absorption of the dead tissues as the connecting link is the immediate cause of the fever. The presence of gas, as decomposition supervenes on sphacelus, is probably a co-operative cause, subsequently, by its direct influence on the nervous system. Absorption of dead matter primarily, nervous sympathy secondarily, and ultimately both together, induce and maintain the typhoid fever which proceeds from mortification.

#### TREATMENT OF MORTIFICATION.

Taking a comprehensive retrospect of the pathology and etiology of (ulceration and) mortification, the Indications of Treatment are four:—

(1) To remove the cause or causes, in operation, and thus arrest the progress of death.

(2) To remove the dead part—*e.g.*, a slough, a sequestrum, a limb; and the proper time for such surgical interference.

(3) To solicit the natural separation of the dead part, with reparative closure of the blood-vessels, simultaneously and co-extensively; and the reparative process of granulation and cicatrization, subsequently.

(4) To control the constitutional disorder, consequent on mortification.

(1) The causes of Mortification are, as we have seen, external and internal.

Of *External* causes; some only are persistent in their operation, and therefore practically important in that respect. Mechanical violence, heat, cold, electricity, as lightning, and chemical decomposing agents; are external causes, the operation of which is all but momentary. Animal poisons introduced into any part of the body, are persistent causes, so long, at least, as any such poisonous matter continues operative. Hence the importance of their early removal. This may be accomplished in various ways.

The application of a cupping-glass is calculated to withdraw the poison, and without sacrificing the part. Free excision of the part itself, may remove the poison, but with a proportionate mutilation. Neutralization of the poison by caustics, or the actual cautery, with destruction of more or less of the textures, *in situ*; is a resource of an intermediate character. A bandage applied with some tightness above the part affected, in the case of a limb, may prevent poisonous matter from entering the general circulation.

Of these four appliances, cupping is the most practicable and effectual.

Of *Internal* causes; some only are removable by any known remedial measures.

*Blood-conditions*, as pertaining to some altered *quality* of the blood in circulation, are thus, for the most part, beyond control. Such are the blood-diseases of carbuncle and boil, erysipelas, small-pox, malignant scarlatina, glanders, ergotism, scurvy, and constitutional syphilis; the two last more especially inducing ulceration.

Conditions pertaining to a deficient *quantity* of blood as causes of mortification, are more amenable to treatment.

(a) Arteries are liable to six such causative conditions, three of which may be effectually overcome—Arteritis, Aneurism, and Wound of a main artery. The first-named disease should be treated according to the rules laid down for inflammation in general; the second and third conditions are fully considered with regard to treatment, under their respective headings.

(b) Veins are liable to five analogous causative conditions; three of which are remediable—Phlebitis, Aneurismal Varix and Varicose Aneurism, and prolonged Pressure on a main vein, as by a tumour or tight bandaging. The treatment of these conditions will be found in their proper places.

(c) Capillary vessels in relation to mortification, are commonly associated with the pathology of Inflammation. Defective capillary circulation, as connected with a comparatively avascular condition of structure, is another internal cause; and intensity of inflammatory hyperæmia and effusion, as dependent on a highly vascular condition, is a third such cause. The one suggests stimulating embrocations, friction, and other similar appliances, to promote the deficient circulation—*e.g.*, in the treatment of bed-sores resulting from pressure which reduces the skin to a virtually avascular condition. The other condition suggests local depletion, and other similar measures, as for inflammation.

Ulceration, resulting from causes precisely analogous to those of Mortification, will require similar measures for their removal. Thus, for example, chilblains, occurring as they do in persons of weak circulation, are prone to ulcerate, and are best treated by spirit lotions and other stimulating applications.

Lastly, defective *nervous influence*, of some kind, has an important causative relation to Mortification and Ulceration; but the removal of this internal cause—the restoration of such influence—may be very difficult. If the occasion of defective nervous influence be local and mechanical, as pressure from a tumour on a nerve, above the seat of sloughing; its removal will be curative. But in some such cases, the source of pressure may not be accessible; and in others, persistent or recurring, thus frustrating the treatment. [P. p. 566.] In cases not referable to any mechanical cause, strychnine administered in small doses,—the sixteenth or twelfth of a grain, and continued until some slight tetanic twitchings of the muscles ensue, may have some efficacy in restoring nervous influence; and galvanism in like manner.

(2) Removal of the dead part by operation, and the proper time for such surgical interference.

As the *immediate* cause of the constitutional disorder, removal of any mortified part,—a slough, sequestrum, or a limb, is an indication of treatment obviously necessary. But the earliest opportunity for fulfilling this indication, with due regard to the non-recurrence of gangrene in the part adjoining, may be a question for the Surgeon's consideration.

The removal of a loose slough of soft textures or a sequestrum of

bone, cannot admit of any such doubt; for there and then, mortification has become defined.

*Amputation* of any part, as a limb, is a question respecting the *spreading* of gangrene, and the probability of its *recurrence* in the stump.

The consideration which *partly* determines this question is, the constitutional or the local origin of the gangrene. In the former case, spreading *without limitation*, as to its extent, amputation must be postponed *until* the "line of demarcation" has formed; in the latter, limited in its extent to the *source* of gangrene, and probably restricted to within that boundary,—by the establishment of a collateral circulation, from above to below; amputation may be performed *prior* to the formation of the line of demarcation.

But in *certain* of these naturally limited gangrenes, the limitation cannot be *foretold*, simply because the exact situation of the causative condition cannot be diagnosed. Of arterial conditions; such are ossification of a main artery or arteries, leading to senile gangrene; arteritis, indefinite in a lesser degree, as to its extent; embolism; and partial rupture of an artery without any external wound. Of venous conditions; such also are fibrous obliteration of a large vein; phleboliths or vein-stones impacted; and phlebitis, indefinite as to its extent. Hence, in all these cases, arterial and venous—the treatment appropriate for the particular causative condition having failed—amputation must be deferred until *such time* as nature has indicated by the formation of the line of demarcation, that limitation which cannot be foreseen. The venous conditions referred to, seldom, if ever, necessitate amputation.

On the other hand, the line of demarcation can be foretold, in other cases of *definitely* local origin. Such are aneurisms—spontaneous and traumatic, and wounds of a main artery; aneurismal varix, and varicose aneurism; and any occasion of prolonged pressure on a large vein. Hence, in all *these* cases,—arterial or venous,—the treatment appropriate for the particular causative condition having failed—amputation may be resorted to before the formation of the line of demarcation has indicated the actual extent to which the gangrene will spread. Generally speaking, the rule for amputation may be thus stated, in all cases of local origin; *idiopathic* gangrene, however caused, suggests the postponement of amputation *until* the limitation of gangrene is declared by Nature; whereas, *traumatic* gangrene, however caused, suggests amputation more immediately; the anticipation of Nature by Surgical Art, then being justifiable. Two exceptions are urged by Erichsen—namely, gangrene from frost-bite, and that from severe burns. In these injuries, he considers it better to wait for the formation of the line of separation, and then to fashion the stump through or just above it, as the circumstances of the case require.

In *Spreading* traumatic gangrene, the question of amputation should be determined rather by the consideration that a constitutional cause is in operation. Postponement of amputation, therefore, pending the formation of the natural line of demarcation, is the rule of treatment.

(3) Solicitation of the natural separation of the dead part, with reparative closure of the blood-vessels, simultaneously and co-extensively, and the reparative process of granulation and cicatrization, subsequently.

*Constitutional* gangrene, and gangrene arising from *local* conditions the exact situation of which cannot be diagnosed; may have compelled the postponement of amputation, pending the natural limitation of gan-



grene; but Surgical Art should solicit this limitation, and thus also, if possible restrict the extent to which the gangrene might otherwise have spread. By maintaining the *temperature* of the part, not yet mortified, the local circulation may become diffused sufficiently to sustain its vitality; whereby the line of demarcation between the living and the dead portions will be declared. Hence, the preventive value of cotton-wool, with which material the limb should be deeply enveloped. This padding need not be reapplied for some days, the gangrenous part being covered with lint soaked in a chlorinated, carbolic, or other antiseptic lotion.

In *senile gangrene*, the line of demarcation having formed, and separation of the dead part, slowly taking place; reparative closure of the blood-vessels will be promoted by a light poultice or epithem of moist spongopiline, to encourage adhesive inflammation. When the soft textures are thus safely detached, the bone may be sawn through, and the otherwise natural amputation completed by this amount of surgical interference.

Granulation and cicatrization supervene as in the healing of a healthy ulcer, although perhaps more slowly than usual. Simple water dressing or some gently stimulating lotion, will therefore generally prove sufficient in the way of topical treatment. Balsam of Peru, pure or diluted, with an equal part of yolk of egg, is highly recommended as an application in these cases. Remembering the persistent cause of gangrene—namely, ossification of the arteries; exposure to cold must ever be avoided, and the circulation in the legs cherished by the patient wearing thick woollen socks, flannel drawers, and other such warm clothing.

(4) *Constitutional Treatment*.—Prior to closure of the vessels, the constitutional disorder consequent on gangrene—the *typhoidal* fever, requires supporting measures; an easily assimilated diet, comprising proportionately more animal food, malt liquor, and alcoholic stimulants, will prove most beneficial. Of medicinal stimulants and tonics; the sesquicarbonate of ammonia and chlorate of potash, with cinchona bark or cascarilla, form a combination, which is, I think, more lauded in the books, than suggested by pathology or sanctioned by experience. Opium is, generally, a remedy of great value, apparently by subduing the nervous excitement and promoting the capillary circulation, thus aiding the process of separation. It should be administered in small but repeated doses, to the amount of from two to four grains in the twenty-four hours, and increased as the system is brought under its influence; but opium is contra-indicated or must be discontinued, whenever it disturbs the digestive organs or occasions headache.

*Inflammatory* fever, in some degree, accompanies occlusion of the vessels during the separation of the gangrenous part; opium may therefore still be continued to suppress nervous excitement and the heart's action, while it sustains adhesive inflammation. Any topical measures to regulate the inflammation are unnecessary, or would be absolutely provocative of gangrene unless applied with the most tentative caution.

This due consideration and balance of constitutional and local treatment, with watchful supervision of the remedial agents employed, constitutes the scientific practice of medical and surgical art as responsive to the ever-changing conditions of pathology—the body in disease.



## DISEASES OF THE BLOOD.

## CHAPTER V.

## SCROFULA.

SCROFULA is a constitutional disease of "blood-origin" because possessing the family features of this class of diseases. In tracing these family features throughout the various local manifestations of scrofula, I shall not include those of an allied blood-disease—Tuberculosis; for these diseases do not appear to be identical, as some pathologists have maintained, and even still allege. I endorse the view held by Mr. Paget, that *this* is their relation—"the scrofulous constitution implies a peculiar liability to the tuberculous diseases, and that they often co-exist." But "their differences are evident, in that many instances of scrofula (in the ordinary meaning of the word) exist with intense and long-continued disease, but without tuberculous deposit; that as many instances of tuberculous disease may be found without any of the non-tuberculous affections of scrofula; that, as Mr. Simon has proved, while diseases of 'defective power,' may be experimentally produced in animals by insufficient nutriment and other debilitating influences, tuberculous diseases are hardly artificially producible; and that nearly all other diseases may co-exist with the scrofulous, but some are nearly incompatible with the tuberculous."\*

*General Symptoms.*—Scrofula—thus distinguished from tuberculosis—exhibits itself locally by "mal-nutrition and chronic inflammation." This inflammation is scarcely expressed by pain or heat, or redness, but rather by swelling, more or less considerable and doughy, slowly enlarging, and tending to suppuration; yet scrofulous suppuration is unwilling, so to speak, and the pus a mixture of curd and serum. Should a scrofulous abscess point, the skin thins, but gradually, and assumes a purplish tint; an irregular rent follows after some time, and the flaky matter rolls out. Perhaps this aperture gets blocked up and imperfectly closed; the matter reaccumulating, again to be discharged, and so on from time to time. Or the aperture may remain free, with puffy everted edges of a purplish colour, and the discharge continue—now thick, now thin.

The *scrofulous ulcer*, which eventually results is equally indolent. It persists, with a thin, livid, undermined margin, large, pale, flabby granulations and a gleet discharge; although sometimes pretending to heal, by this discharge crusting over its surface. Should cicatrization ensue, the scrofulous cicatrix appears drawn, puckered, and incomplete. Small bridges form across the ulcer, underneath which a probe can be passed readily, in and out, here and there. Nature does but "skin and film the ulcerous spot."

*Special Forms.*—Scrofula is essentially a "pervading" disease. It blossoms and bears fruit chiefly in the absorbent glands, in the skin and cellular texture, mucous membranes, bones and joints, eyes, salivary

\* Surg. Pathology, 1853, vol. ii.

glands, tonsils, ears, breasts, and in the testicles. Then, again, in some cases, various parts are simultaneously affected, in others consecutively; the scrofulous affection "migrating" from one texture or part to another texture or part. But their order of priority cannot be stated with accuracy. In some textures, the scrofulous affection is more *pronounced* than in others.

*Absorbent glands*, so called, appear to invite the deposit of scrofulous matter. At first soft and fleshy, these glands enlarge and harden; "portions of each gland are observed to have altogether lost their flesh colour, and acquired a degree of transparency, and a texture approaching to that of cartilage."\* At length, a soft, white, or yellowish, curd-like substance is deposited. Glandular tumours, thus formed about the neck and groin, sometimes attain an enormous size; in the latter situation, being perhaps half as large as the head of a new-born child. An enlarged scrofulous gland is not necessarily impervious—at least, mercury can be injected in many instances.† Scrofulous glands are remarkably indolent, but eventually they soften and discharge the characteristic pus, —flaky and ichorous, perhaps cretaceous matter; or they remain as soft and spongy tumours, beneath a thin, silky cuticle, which frequently breaks and oozes; or they waste, and are at length represented only by "a few bands of condensed cellular tissue attached to the cicatrized integument."‡

Absorbent *vessels* are said to be rarely the receptacles of scrofulous matter, but there are such instances on record.

Chronic enlargement with suppuration of the lymphatic glands is one of the earliest characteristic manifestations of scrofula. In childhood, therefore, these glands may be found as just described, in various stages of scrofulous inflammation and suppuration. Yet this is a rare event in children under two years of age. Thomson witnessed it earlier than this, and Cullen mentions a case in which the disease broke out at the very early period of three months. Taking the other extreme, Thomson found the mesenteric glands affected with scrofulous inflammation in persons of *very* advanced age.

In various parts, also, of the body, the lymphatic glands may become scrofulous. Those in the neck—*glandulæ concatenatæ*—are perhaps most frequently affected; and, according to Thomson's experience, scrofulous enlargement, &c., of these glands is more commonly symptomatic of irritation in neighbouring parts than an idiopathic condition,—provided, in either case, the scrofulous diathesis be present. This enlargement of the cervical glands is apt to arise from slight and transitory injuries and affections of the hairy scalp, ears, eyes, nose, and more particularly from slight and temporary affections of the teeth, gums, and other parts within the mouth. Decay of the first teeth is often the immediate cause of scrofulous glandular swellings in the neck, but their eruption, seldom or never.§ The axillary and crural glands are less frequently affected than those of the neck; and Thomson believes that their enlargement also is symptomatic, in this case, by absorption of scrofulous matter from parts more or less remote. This authority was acquainted with but few instances of idiopathic scrofulous swellings of the glands in the groin or armpit. The mesenteric glands are very liable to undergo scrofulous inflammation,

\* Med.-Chir. Trans. Edin., vol. i. p. 683. (Abercrombie.)

† Cyclop. Practical Medicine, 1834, vol. iii. p. 705.

‡ Ibid.

§ Lectures on Inflammation, p. 157.

constituting that formidable disease, *tabes mesenterica*, by arresting the absorption and passage of chyle through these glands, and thus inevitably depriving the whole body of its nutriment. A tumid abdomen, with progressive emaciation, begets suspicion of this disease; while detection of the mesenteric mass, by palpation and percussion, will go far towards confirming our diagnosis. Besides, however, the physical signs and their interpretation, which Pathology supplies, there are, as regards all diseases, with few exceptions, other circumstances whose evidence should be weighed. We look for the concurrence of some other expressions of the scrofulous diathesis. Age, also, should be taken into account; but, in this respect, Thomson found the mesenteric glands affected in children two years old, in persons between twenty and thirty, and in those who had passed their sixtieth year.

The *cellular texture* is peculiarly liable to exhibit scrofulous swellings, bordering on suppuration or actual collections of matter.

In the subcutaneous cellular tissue, small *nodules* are apt to form closely resembling scrofulous glands in appearance. Of this kind are the swellings described by Thomson as being "soft and puffy," and having little or no disposition to suppurate. "They often appear very suddenly; and from the absence of pain and discoloration, they may exist a long time without being perceived. They are usually of an oval figure, and seem to be produced by the effusion of a fluid into the interstices of the cellular texture; they are very variable in their size, being one day more prominent and tense, and the next more flaccid." Subcutaneous *abscesses* may form, and are usually numerous. When an absorbent gland suppurates and bursts, a fistulous sore is the result; but abscess in the subcutaneous cellular texture commonly terminates in an open scrofulous ulcer.

In the *sheaths of muscles*, large chronic abscesses sometimes gather insidiously, containing the pus which characterizes scrofulous suppuration.

The *skin* is more than liable—it is prone—to scrofulous eruptions and ulceration. Its wrinkled seams and puckered scars are familiar to common observation. And these vestiges are not unfrequently "symmetrically" disposed on either side of the body. Indeed, this symmetrical distribution is more common in scrofulous affections of the skin, or at least, is more apparent in that texture, than in those of other textures. An instance of remarkably symmetrical scrofulous scars on the neck and fore part of the chest, occurred in a patient of mine at the Royal Free Hospital. In the middle line, a vertical scar extended downwards to the sterno-clavicular articulation, terminating in a kind of root, and upwards to the os hyoides. From thence a branch scar passed upwards and backwards to the angle of the jaw, on either side; and from this again, on either side, another seam extended upwards to the mastoid process, and downwards on the sterno-mastoid muscle. Either axilla was the seat of an horizontal seam, which discharged a small quantity of scrofulous matter. According to the special experience of Erasmus Wilson,\* cutaneous scrofula is presented in two conditions—that of *tubercles*, and that of *ulcers*. Scrofulous tubercles are small, purplish or livid, indolent tumours. They soften internally and discharge an imperfect pus, remain open or fistulous for a long time, and on disappearing, frequently leave

\* Diseases of the Skin, 1857.



hard knots in the skin. They appear on the neck and face, and near ulcers resulting from inflammation of the absorbent glands. When such tubercles have partially discharged their contents, a crust of inspissated matter forms, which being rubbed off occasionally, exhibits an open sore, with an ichorous discharge, and no disposition to heal. Eventually an ugly cicatrix or scar marks the site of these sores. Usually but one scrofulous tubercle arises; sometimes a group of three or four close together, which may have a circular arrangement, enclosing an area of thin, shining, livid or purplish skin. Rings of this kind occur chiefly on the back of the hands and feet. They are very intractable.

The characters of the scrofulous ulcer need not be repeated. An irregular, livid, and puckered scar is its remnant. Such cicatrices are seen mostly in the neck, near enlarged glands, and in the neighbourhood of joints.

Inflammation of the *matrix* of one or other of the *nails* is not uncommon, more particularly in young persons having the scrofulous diathesis. Scrofulo-derma ungueale, so named, begins by inflammation of the skin immediately around the edges of the nail about to be affected; then follows considerable swelling, with vivid redness of the end of the finger, extending even to the bone, and presenting the appearance of a clubbed finger. The nail is shed, disclosing an angry raw surface, upon which, from time to time, there reappears a rugged, ill-formed and imperfect nail. Fungous granulations and unhealthy pus continue for perhaps many months.

Other *cutaneous* manifestations of scrofula are noticed by some writers. Porrigio favosa, larvalis, and furfurans; eczema impetiginodes and rubrum, in their chronic forms; and that variety of lupus which appears as small, red, button-like, indolent tubercles, chiefly on the lips and nose, occasionally on the genitals. These tubercles excoriate and run into eroding ulcers, with pale, shining, spongy granulations and encrusted margins; or perhaps this work of destruction is concealed by a thick incrustation, which every now and then drops off, exposing its subjacent ravages.

The *osseous system* and the *joints* seem to invite scrofulous inflammation—in this respect contrasting with the indisposition evinced by these structures towards the syphilitic poison, unless reinforced by mercury. The bones and joints, then, are conspicuous in the history of scrofulous manifestations. And both may be coupled together, because it is *near* to joints that the bones are commonly affected. In the extremities of long bones, or in the bones of the carpus and tarsus, their cancellated portion, chiefly, undergoes a series of structural changes, which, with the symptoms, or rather, signs by which they are denoted, will be traced consecutively in describing Diseases of the Bones. I allude to scrofulous caries. Sometimes this species of mal-nutrition runs its course within the *shaft* of a long bone, but generally speaking, as I have said, in the neighbourhood of joints. The latter are secondarily invaded, caries so placed then being denominated “scrofulous disease of the joints.” An inflammation of the synovial membrane, known as “scrofulous synovitis,” was formerly regarded as a primary and distinct disease. More than probably, however, it arises by extension of the destructive process from the cancellated bone.

In the career of scrofula, *mucous membranes* are not exempt from harm, particularly if its blood-associate, tuberculosis, be considered an ally. The eyes, ears, nose, upper lip, tongue, tonsils, salivary glands, and



larynx, severally exhibit scrofulous inflammation; yet this is not altogether limited to the mucous membrane in connexion with these parts.

Scrofulous ophthalmia is a variety of conjunctivitis, characterized by great intolerance of light; so that the child (for this affection occurs mostly in young subjects) seeks a dark room, or buries its head in the bed-clothes, and screws its brows together with screaming agony on any attempt being made to examine the eyeball. From habitually endeavouring to exclude the light, the corrugator and orbicularis muscles become hypertrophied, eventually giving a remarkable heaviness of expression. When the eyelids are separated, a copious flow of tears trickles down the cheek, excoriating the face. The eyeball is now involuntarily upturned to avoid the light, a patchy redness is observable on the conjunctiva, and vesicles or pustules are seen here and there at the margin or on the surface of the cornea. These pustules burst and expose small ulcers. Frequently an interstitial deposit overshadows the whole cornea, which thus becomes thickened and opaque (pannus), projecting also, so that the eyelids cannot be closed. This is one destructive sequel, and should ulceration of the cornea not terminate comparatively favourably—in specks of opacity, perforation of the anterior chamber is inevitable, the aqueous humour is discharged with prolapsus of the iris, and the eye collapses.

Fretting ulceration of the Meibomian glands, attacking the margin more especially of the eyelids, and known as ophthalmia tarsi, is a frequent concomitant of scrofulous ophthalmia; or this diseased condition extends to the iris, giving rise to scrofulous iritis. But there is nothing characteristic about this variety of iritis, taken *per se*; and indeed it is only as one of a *series* of local manifestations that we venture to designate it “scrofulous” iritis, and refer the whole series to one and the same constitutional cause in operation.

The organs of hearing do not escape. Chronic suppuration perforates the tympanum; the ossicula crumble, loosen, and are washed out by the discharge.

The nose assuredly enjoys no immunity. Habitual swelling, ulceration, and fœtid discharge from the pituitary membrane—ozæna—may or may not be accompanied with caries and discharge of portions of the spongy bones.

The upper lip is commonly tumid, protuberant, and chapped. Fissures also and ulcerated spots are seen on the tongue. Nodules, moreover, superficially imbedded in the substance of this organ are said to arise in most instances, and to present the following characters. They vary in size from a small shot to that of a horsebean; are painless, unless subjected to firm pressure, which occasions a pricking sensation. The superimposed mucous membrane reddens, soon breaks in the centre, and forms an ulcer, which spreads and destroys by sloughing erosion; accompanied with much pain, profuse salivation, furred tongue, and fœtid breath. If cicatrization ensue, hardness still remains; fresh nodules also form in other parts of the tongue.\*

Chronic and considerable enlargement of the tonsils, with perhaps indolent ulceration, is another outbreak of the scrofulous diathesis; so likewise is swelling of the sub-lingual, sub-maxillary, and occasionally the parotid salivary glands; but these affections alike owe their significance to the invariable co-existence of other local diseases of more unequivocally scrofulous origin.

\* Cyclop. Practical Medicine, 1834, vol. iii., art. Scrofula.

This remark holds good of another inflammation of mucous membrane, and the last which I shall notice in connexion with scrofula. Chronic laryngitis may be due to this constitutional cause. The vocal cords become thickened; the voice therefore is hoarse or squeaking, and the breathing embarrassed; a tickling cough from time to time ejects a slimy, not frothy, expectoration, streaked with blood perhaps; or the sputa are muco-purulent. In either case the breathing is relieved by this expectoration; but eventually ulceration of the rima glottidis renders its closure imperfect, the act of coughing incomplete, and expectoration therefore difficult; respiration is proportionately more embarrassed. Should ulceration of the epiglottis supervene, there will be a corresponding difficulty of deglutition. I need not enlarge this description; sufficient for my purpose to identify chronic laryngitis, while the invariable co-existence of other local affections of more exclusively scrofulous origin associates this disease with that series of local manifestations which proceed from the scrofulous blood-crisis.

In like manner I have to notice a certain *mammary tumour*, first described by Sir A. Cooper.\* “In young women,” says this author, “who have enlargement of the cervical glands, I have sometimes, though rarely, seen tumours of a scrofulous nature form in their bosoms, confined in most cases to a single tumour in one breast; but in one case two existed in one breast, and one in the other. They are entirely unattended with pain, are distinctly circumscribed, are very smooth on their surfaces, and scarcely tender to pressure. They are very indolent, but vary with the state of the constitution, diminishing as it improves, and increasing as the general health is deteriorating. They can only be distinguished from simple chronic inflammation of the breast, by the absence of tenderness, and by the existence of other diseases of a similar kind in the absorbent glands of other parts of the body. They produce no dangerous effects, and do not degenerate into malignancy.”

Lastly, a peculiar enlargement of the testicle, or rather, of the *epididymis*, is worthy of special notice among the local manifestations of scrofula; and it particularly exhibits the usual characters of stealthiness and slow development. A small nodule, consisting of yellow friable matter deposited within the tubules or ducts, appears generally at one end of the epididymis; little pain or tenderness attends this structural change, and it may progress without complaint. Another and another such nodule forms on the surface of the testis, but generally connected with the epididymis, which becomes beset with three or four small tumours. Thus the testicle itself feels enlarged and irregular at an early stage of this disease.

It has been stated† that scrofulous matter is also deposited within the body of the testis, in the form of pearly or greyish bodies, of the shape and size of millet-seeds—*i e.*, grey granular tubercles, which I suppose this description denotes. That these tubercles have a linear arrangement, like strung beads, less abundant and less regular in the anterior part of the organ than towards the rete-testis, where they are closely set, and sometimes confluent; and that they undergo transformation into a yellow friable cheesy substance, which at a later period softens, and is often broken up into a curdy purulent fluid, the gland-structure being absorbed to give place to this tuberculous matter. But, if tubercles are deposited within the testicle itself, this structural change signifies little in

\* Diseases of the Breast, 1829, chap. viii.

† Diseases of the Testis, Curling, 1856.

reference to an early and exact diagnosis, for the "testis is often masked by small local effusions of fluid in the tunica vaginalis," the surfaces of which are partially adherent.

Now, the epididymis may remain nodose for many months; the nodules quiescent, or enlarging very slowly, and becoming painful. At length one declares itself more than the rest, attaches itself to the skin, which then assumes a purplish discoloration, ulcerates, and discharges a curdy purulent matter—the substance of the nodule. Other nodules undergo successively this process of disintegration, softening, and evacuation; but, unlike healthy abscesses, they do not heal. Fistulous openings obstinately continue to exude a mixed discharge—now curdy, now serous, now seminal; and in this advanced stage of the disease, destruction of more or less of the gland substance is inevitable. According to Sir B. Brodie's observations,\* occasionally one testis is completely disorganized; more frequently the organ is only partially destroyed, and a considerable portion of the glandular structure remains unimpaired. Sometimes the disease is confined to one testicle; sometimes both are similarly involved.

By this process of disorganization and protracted discharge the testicle is drilled and worm-eaten, as it were; so that eventually the organ collapses and shrivels up—a fragment only of its former self. There is seldom, therefore, any protrusion of gland-substance through the fistulous scrotum; on the contrary, in a favourable case the apertures gradually become inverted and depressed,—leaving, after the lapse of time, a puckered cicatrix, adherent to the remaining portion of the gland, as a lasting record of all this mischief.

*Blood-origin.*—In concluding this summary of many local diseases, which, possessing the same general characters, are fairly associated under the name of Scrofula, it is impossible to overlook at least two general facts that indicate their blood-origin. These diseases are perversions of nutrition in "many" textures and organs simultaneously; they "migrate" from one locality to another, and they are occasionally symmetrical. So, therefore, scrofula is, properly speaking, a blood-disease, and the diseases alluded to are local manifestations of a constitutional cause in operation.

*Blood-pathology.*—Nothing definite is known respecting the composition of the blood in scrofula. The blood is said to be rich in its amount of fibrin, but thin, of inferior plastic quality, and poor in its proportion of red corpuscles;—such is the result of analysis by Andral and Gavarret: that the "solids of the serum" are increased, and the "blood-globules" diminished, was the result of Dr. Glover's analyses;† and so on I might enumerate the conclusions of many other distinguished chemists.

*Causes.—Temperament.*—Certain bodily organizations evince a tendency to scrofula, and beget a suspicion that it will declare itself in some way, sooner or later. Individuals thus constituted are ever verging on this morbid condition, with threatenings of its outbreak here or there; but it must be confessed that no one temperament alone possesses the scrofulous character. It is the tendency of those whose circulation is habitually weak—are *leucophlegmatic*—who have flabby muscles, a dull muddy complexion, large heads, pigeon breasts, tumid bellies, and large joints; but then the strumous tendency is manifested in those persons also who, with a more active circulation, are rather of

\* London Med. Gazette, vol. iii. p. 377.

† Pathology and Treatment of Scrofula. Fothergillian Prize Essay, 1846, p. 115.



the *sanguine* temperament, have firmer muscles, a clear, transparent, ruddy complexion, which readily assumes a purple or livid hue by exposure to cold. The circulation, although active, is susceptible. Children, therefore, not uncommonly occur in children of this temperament; while their yellow or reddish hair, large lustrous blue eyes, crimson-patched cheeks, and pouting upper lip, are associated with that lively, impulsive, affectionate, and precocious disposition which so often raises hopeful expectations, never to be realized.

In contrast, however, with this organization and with these mental endowments, the same strumous tendency may be evinced in the highest degree by those who, without any marked character of circulation, are habitually subject to biliousness. In such persons the liver seems to be their weak point. Sluggish, yet enduring power is theirs also; and hair approaching black in colour, a dark olive or yellowish complexion, and dry skin, are aptly associated with a gloomy, often resolute, and reflective disposition. Theirs is the *melancholic* temperament. These are the chief signs of the scrofulous *diathesis*, although it *may* appear also in persons of the *nervous* temperament; and, indeed, the same tendency can be induced in those who are congenitally most indisposed to it when subjected to circumstances favourable to its development.

*Hygienic Conditions.*—Whatever impairs the nutritive qualities of the blood and its circulation may produce scrofula; therefore, deficient or defective food, indoor-life, insufficient ventilation, want of cleanliness and excretion, poor clothing, cold, damp, and even dark localities, with other *circumstances* of similar character, are the nurseries and nurses of this blood-disease. At the same time, *individual* predisposition, as usual, plays its part; for among a family of children in precisely the same hygienic circumstances, one becomes scrofulous, while the rest escape.

*Treatment.*—*Preventive* measures are far more efficacious than remedial treatment. They consist in the anticipation or timely removal of the predisposing hygienic conditions just adverted to; any inborn predisposition by temperament being beyond prevention. Due attention to food is primarily important. In the absence of more precise knowledge respecting the blood-condition in scrofula, it is impossible to direct and regulate the diet chemically. Experience, however, suggests a light nutritive diet, and not to overload the stomach by a heavy meal. Stimulants may be necessary to assist digestion, but they should be indulged in sparingly. The pampered scrofulous child of affluent parents is as badly off as the ill-fed child of the poorest. The bowels, which are very apt to be costive, or at least irregular in their action, will require the assistance of gentle aperients, such as rhubarb or the confection of senna. Not less important is daily exercise in pure air, and ablution not only to cleanse the skin, but to invigorate the circulation and promote excretion. Hence, sea-bathing may prove very beneficial. Friction with the horse-hair gloves and belt, or a rough towel, and warm clothing, with flannel next the skin, are likewise salutary. But, a warm, dry, light, locality for habitation, in a well-ventilated and well-drained dwelling, constitute the hygienic surroundings which are most preventive of scrofula. The latter, especially, is a hard prescription for the poor to carry out. Among, however, the many blessings bestowed on them in this vast metropolis, by the imperishable philanthropy of Mr. George Peabody, a yearly decreasing predisposition to scrofula, will perhaps be the greatest boon.

*Curative* treatment implies the same continued attention to the removal



of any causes provocative of this disease. The hygienic conditions of diet, exercise, air, ablution for cleanliness and invigoration, clothing, and climatic influence, are still of paramount importance. But certain medicinal agents, principally iron, iodide of potassium, bark, and cod-liver oil, have an acknowledged therapeutic value.

Iron may be given in the form of *vinum ferri*, the ammonio-citrate, the citrate or the sulphate of iron; the latter of which preparations I prefer, as it improves the blood more effectually. This is denoted by a notable arrest or diminution of any scrofulous deposit in the glands or other parts of the body.

Iodide of potassium has a beneficial influence on scrofulous deposit, apparently by promoting its absorption; but I must confess that this influence seems to me overrated. Iodide of iron is unquestionably remedial, but this is probably due to the iron rather than the iodine. Perhaps, therefore, the therapeutic value of iodide of potassium in scrofula, may be attributed to the latter ingredient; an explanation in harmony with the generally accredited efficacy of other preparations of potash in this disease.

Cod-liver oil, must be regarded rather as a food than a medicine; by supplying the proportionately diminished amount of fat in the blood, relative to the fibrin. It certainly has a most marked influence on scrofulous mal-nutrition. Cinchona bark, whether in the form of decoction or tincture, or quinine, is highly serviceable as a tonic in strengthening the circulation, and thence indirectly improving nutrition and all other functions. But it has no special influence on scrofula, and must be regarded as an adjunct to other medicinal measures. I am thus accustomed to prescribe the sulphate of iron in doses of three to five grains, with one or two grains of the disulphate of quinine, three times a day; coupled with a teaspoonful of cod-liver oil.

*Local* treatment has some effect on the *chronic enlargement of glands*, and of other parts, arising from scrofulous deposit. Applications of the compound tincture of iodine, or the stronger iodine-paint, may be advantageously aided in their stimulant operation by the pressure of strapping with soap plaster, or bandaging. Usually, however, these glandular enlargements will not subside, at least under topical treatment. When *abscess* forms, and discharges subsequently as an *ulcer*; these results must be treated accordingly. Much has been said about the virtues of caustic potash and other barbarous modes of apparently punishing a scrofulous abscess or ulcer; but there need be nothing peculiar in their local treatment, and it should ever be remembered that constitutional treatment can alone have any curative efficacy in scrofula.

*Operations* for scrofulous conditions of the bones, joints, or other parts, should be determined by the same consideration. Constitutional treatment will often succeed in averting the necessity for excision or amputation; a highly important consideration, since any local form of a constitutional disease is always an unfavourable condition for operation, and the removal of the part affected can in no way cure that disease as the primary cause. Hence, also, the postponement of such operation may not unfrequently be justifiable; and until the local condition becomes more defined, or its progressive extension renders operative interference imperative, whether with regard to the part affected or its reactive influence on the general health.

## SCURVY AND PURPURA.

*General Symptoms.*—Scurvy and Purpura are alike manifested by hæmorrhages into many textures, occurring contemporaneously or consecutively; and it will be readily imagined that these hæmorrhages occur with greater facility in some textures than in others. Into *cellular* tissue, for example, blood is very apt to escape. Such spontaneous hæmorrhages result from alterations which the blood itself has undergone.

SCURVY.—*Symptoms.*—The symptoms of scurvy may be well illustrated by a supposed case. A sallow and dejected-looking man, whose strength has been gradually failing, becomes the subject of hæmorrhages of a peculiar kind. The gums are turgid, spongy, and rotten; they ooze blood on the slightest pressure; the teeth loosen in their sockets and drop out. This fungous condition of the gums ceases abruptly at the reflexion of the mucous membrane to the lips, which are extremely pale, so also are the tongue, fauces, and inside of the cheeks. In some rare instances, however, this lividity extends nearly all over the hard palate. Red or livid spots are found—principally on the legs—together with bruised-looking patches, of a yellowish-green colour, swollen and hard as brawn.

Extensive effusions of *fibrin* rather than pure blood—forming very hard, broad, and painful swellings—are found imbedded in the deep cellular texture and between muscles. Over these fibrinous mats, the skin sometimes retains its natural colour, but usually appears bruised—is always thickened and brawny, and adherent to the subjacent textures. Swellings such as these occur particularly in the thighs and legs, but most commonly in the hams, occasioning stiffness and contraction of the knee-joint. Nodes also arise from this effusion taking place between the bones and their periosteal investment; the tight swellings formed thereby giving great pain upon the slightest motion, even by turning in bed. None of these effusions, whether of fibrin or blood, ever suppurate; nor do the nodes just mentioned, however large their size, ever cause the bone to exfoliate.

The dark livid or purple colour of scurvy overshadows any skin-eruption, wound, or ulcer, which may chance to be present during this disease. A dark grumous coagulum juts out from the surface of an ulcer; and this—which, owing to its appearance, has been named by sailors *bullock's liver*—often attains an incredible size in the course of a single night. To conclude the catalogue of hæmorrhagic lesions, repeated issues of blood from the nose are common; blood may be coughed up or vomited, lost by the bowels, and perhaps passed with the urine.

Scurvy is apt to prove fatal suddenly, from exhaustion. This remarkable feature in its career, with others of instructive moment, were exemplified in an equally remarkable manner during Lord Anson's expedition, 1740-44. The narrative states:—"Many of our people, though confined to their hammocks, ate and drank heartily, were cheerful, and talked with much seeming vigour and in a loud, strong tone of voice; yet, on their being the least moved, though it was only from one part of the ship to another, and that in their hammocks, they immediately expired; others, who confided in their seeming strength, and resolved to get out of their hammocks, died before they could reach the deck. It was no uncommon thing for those who could do some kind of duty and walk the deck, to drop down dead in an instant, on any endeavour to act with their utmost vigour; many of our people having thus perished during the course of this voyage."

**PURPURA.**—Similar *Symptoms* characterize Purpura, but there is not the same marked dejection and feebleness, nor are the gums always fungous. Extravasation of blood occurs in the form of small, round, purple spots, rather than parti-coloured blotches. These spots of blood are scattered in almost every texture. According to Sir Thomas Watson's experience,\* they are not peculiar to the skin, nor to the subcutaneous tissues, but occur occasionally upon all the internal surfaces also, and within the substance of the viscera. For example, on the mucous membrane of the mouth, throat, stomach, and intestines; on the pleuræ and pericardium, in the chest; on the peritoneal investment of the abdominal organs; in the substance of the muscles; and even upon the membranes of the brain, and in the sheaths of the larger nerves; and they may be accompanied with large extravasations of blood in most of the vital organs of the body. Such lesions are necessarily perilous. Bateman states that he witnessed three instances in which persons were carried off, while affected with purpura, by hæmorrhage into the lungs. Watson saw two post-mortem examinations, in both of which a considerable quantity of blood was found spread over the surface of the brain, between its membranes; and in one of these cases blood was extravasated also into the cerebral substance, with extensive laceration.

*Blood-origin.*—Scurvy and Purpura are *plainly* of "blood-origin." The blood itself spontaneously exudes, and appears as a bruise, yet without any bruising force having been applied. This hæmorrhage and ecchymosis takes place in many textures, and visits one after another. The whole organism, in fact becomes leaky, yet without the blood-vessels themselves being in any diseased state.

*Blood-pathology.*—*Scurvy.*—To what morbid condition of the blood must scorbutic hæmorrhage be ascribed? The blood has undergone remarkable and significant changes of colour; from the florid red of health, it has assumed a dark brown or green tint; it appears, also, only half coagulated, the supernatant serum being of a livid colour. Again, the red corpuscles are observed by Drs. Ritchie and Buchanan† to have become irregular in their outline, their disks more flattened, and more disposed to cohere together and aggregate into large insulated masses, than the corpuscles of healthy blood. These peculiar appearances are denied by other observers, who regard them either as inconstant or altogether absent. Dr. Garrod, for instance, affirms, that recent examinations have shown the blood not to be in a dissolved state, as was formerly supposed, but that the globules are normal in appearance, the clot firm and frequently buffed and cupped.‡

The balance of evidence, however, preponderates in favour of the characteristic colour and fluidity of the blood, and the collapse of the red corpuscles.

The chemical constitution of scorbutic blood is doubtful.

In the present state of Chemical Pathology, according to one authority, *potash is deficient*. Dr. Garrod's analyses§ lead him to conclude that the proportion of this alkali is reduced. Other authorities—Becquerel and Rodier||—find the proportion of *soda increased* in scorbutic blood, and that of *fibrin diminished*.

\* Lectures on the Principles and Practice of Physic, 4th Edit.

† Edin. Month. Journ., July, 1847.

‡ Ibid., Jan. 1843.

§ Ibid., 1848.

|| Pathological Chemistry, 1853.



*Treatment.*—*Scurvy.*—The *preventive* and *curative* treatment of this disease, is alike *dietetic*.

It is an undoubted fact that certain articles of diet possess anti-scorbutic properties. Lemon-juice is the grand anti-scorbutic, whereby thousands of persons have been rescued, who otherwise would inevitably have perished from scurvy. 1457 cases of scurvy were sent to Haslar Hospital in the year 1780. Subsequently, in 1795, lemon-juice was provided by order of the Admiralty, through the representations of Sir Gilbert Blane and Dr. Blair. Then only one case of scurvy appears in the hospital returns for 1806; and for 1807, one. Potatoes, whether in a raw state or cooked, are equally anti-scorbutic. Many other articles of diet, more or less in use, are enumerated by Dr. W. Budd,\* and their anti-scorbutic properties compared. So far, the prevention of scurvy is practicable.

But this kind of knowledge is *empirical*; we are ignorant (as Dr. Budd justly remarks) of the *essential* element common to the juices of anti-scorbutic plants, and in which their efficacy resides. Therefore, one plant cannot be substituted for another—prior to actual experience of its anti-scorbutic value—with the sure and certain prediction that it will prove equally efficacious, or more so. And why are we still ignorant of this “essential element,” and incapable, consequently of substituting an untried for a known anti-scorbutic? Because the “blood-condition” essential to scurvy is yet unknown, and that something, by virtue of which various plants are anti-scorbutic, is therefore equally unknown. Accordingly, the prevention of scurvy can be determined only by the results of actual experience.

Mark the further consequences of this empiricism. If *potash* were assuredly known to be the thing in question, it could be procured in almost any emergency from the ashes of any plant or of any wood, and especially, as Dr. Garrod has suggested, from that ubiquitous weed, tobacco, which is rich in potash.

In the present state of knowledge, the commissariat of an army, a navy, or commercial marine—ever liable to be placed in straitened circumstances with regard to all food—are in the dark on this most critical point. In encampments far from home, during sieges and long voyages, the allowance of lemon-juice has perhaps long been exhausted, and fresh vegetables are a dream; when, therefore, under these adverse circumstances, scurvy stealthily threatens, with pallid hue and dejected mien, the light of Pathological Chemistry would supply an unerring guide in search of that yet unknown something—be it potash or whatever else—by which the impending scourge would assuredly be averted. It might be possible, by a simple process perhaps, to extract that needful something from an abundant source at hand, in a locality otherwise well-nigh barren and desolate.

To conclude, on behalf of the prevention of this disease; any new and *untried* kind of food cannot be *substituted*, in an emergency, for another less plentiful; and, should all food run short, then the *essentially* anti-scorbutic constituent cannot be *extracted* from substances perchance close at hand, in which, like a precious pearl, it remains undiscovered, while scurvy is already overshadowing its victims.

Empirical experience is our only resource under these circumstances,

\* Library of Medicine, art. Scurvy.



and the rules which it authorizes for our guidance are necessarily of a very general character. They are enumerated by Dr. Budd as follows:—

Firstly.—Anti-scorbutic properties reside exclusively in substances of vegetable origin.

Secondly.—These properties are possessed in very different degrees by different families of plants; least so by the farinaceous, as wheat, oats, barley; most so by the succulent, as the *aurantiæ*, comprising oranges and lemons; lastly by potatoes.

Thirdly.—The anti-scorbutic property is impaired by the action of strong heat; nevertheless, boiled potatoes are anti-scorbutic (Dr. W. Baly); impaired, also, by vinous fermentation, but improved probably by acetous fermentation.

To show the difficulty of determining the essential treatment of scurvy empirically, I might add, in striking contrast, the conclusions of Dr. Christison in favour of *azotized* substances, and of *animal* origin, perhaps exclusively, such as milk.

These and similar discrepancies, on the part of practised observers, should direct the attention of chemists to the unknown “blood-condition,” as the only standard of comparison whereby to estimate the anti-scorbutic value of different substances, their composition being presumed to be known.

*Purpura*.—Although resembling scurvy in appearance, the curative treatment of purpura, by abstinence, purgation, and venesection, as recommended by the late Dr. Parry, of Bath, is altogether at variance with that which is so efficacious in cases of scurvy; and points, therefore, to some essential difference between these two diseases, otherwise allied. The manifestations of both are unquestionably of blood-origin, yet essentially different in this respect; and not until Chemical Pathology has determined the blood-condition *peculiar* to Purpura will it be possible to interpret rightly the whole etiology of this disease. Its rational preventive and curative treatment will follow.

## CHAPTER VI.

### RHEUMATISM AND GOUT.

**RHEUMATISM.**—*Symptoms and Diagnosis.*—Rheumatism is manifested by an inflammation affecting some portion of *fibrous tissue*; the ligaments and tendons around the joints, are more commonly selected, sometimes the fascia, and very probably the pericardium and endocardium. This inflammation is *specific*. It is denoted, just as common inflammation is expressed, by redness, heat, pain, and swelling; but rheumatic inflammation is characterized by not tending to the effusion of plastic lymph, nor to suppuration and gangrene; unless, indeed, some other texture besides fibrous tissue shares the inflammation, as synovial or serous membrane, when its products are the same as those of ordinary inflammation.

*Fever.*—This local condition is preceded by and accompanied with inflammatory fever, in perhaps its highest degree,—contrasting, therefore, in every way with fever of the typhoid type. A strong, rapid, hard pulse; headache without any delirium, excepting when pericarditis or

endocarditis ensues; acid perspirations and urine; these are the chief phenomena of rheumatic fever. And this fever not only precedes the local inflammation; but possibly runs its course without any such manifestation.

*Blood-origin.*—Rheumatic inflammation, whether exhibited by the joints, the fasciæ, or the heart, is evidently due to the operation of some morbid blood-condition; and for two reasons more especially.

The very fact of the same inflammation affecting, possibly, "many parts"—*e.g.*, many joints—simultaneously, points to the blood as its common cause. So also does the "metastatic" character of this inflammation. Passing from one joint to another—from the shoulders to the elbows, or from the knees to the ankles, perchance back again to the joints first affected, and probably thence migrating to the heart; these and similar alternations of the same character of inflammation betoken some morbid condition of the blood, which, as a reservoir supplying in common all parts of the body, is turned on, as it were, more abundantly (by inflammation), now on this part, now on that. The "symmetrical" distribution of chronic rheumatism,\* in many cases, affecting as it does corresponding parts of either half of the body, is further evidence of there being a blood-disease in operation; while such distribution exhibits also the elective power of similar portions of the same texture.

*Blood-pathology.*—But although the blood, vitiated in some way, is determined to the fibrous texture, by virtue of its elective power, we cannot say what particular ingredient, normal or foreign to the blood's composition, is appropriated thereby. The texture undergoing rheumatic inflammation selects something—but what?—from the blood.

Judging by the acid state of certain secretions—perspiration, saliva, and urine—during an attack of acute rheumatism, it would appear that an *acid* of some kind prevails in rheumatic blood; and, first suggested by Prout,† other authors,—Todd,‡ Fuller,§ C. J. B. Williams,|| Headland,¶ &c.—have since concurred in believing that this acid is *lactic* acid.

It is urged that, as the perspiration contains lactic acid, with lactates of soda and ammonia, and that exposure to cold, checking this secretion, is well known to be frequently followed by an attack of rheumatism; that therefore this disease is due to an accumulation of lactic acid in the blood. But then, sufficient exposure to cold ought invariably to have this effect; or—making allowance for individual peculiarities of constitution—at least in many instances such would be the effect of exposure. Moreover, the not unfrequent spontaneous origin of rheumatism in hospitals, where patients are protected from exposure, is irreconcilable with the theory in question.

Again, it is alleged that primary mal-assimilation—dyspepsia, in fact, of some kind—produces lactic in excess, which accumulates in the blood. But this theory also is not consistent with observation, so far as the absence of any symptoms of indigestion is significant.

Neither has it been demonstrated that lactic acid accumulates in the

\* Med.-Chir. Trans., 1842. Communication by Dr. W. Budd.

† Stomach and Renal Diseases, 1848, p. 84.

‡ Gout and Rheumatic Fever, 1843, p. 143.

§ Rheumatism, Rheumatic Gout, and Sciatica, 1860.

|| Principles of Medicine, 1856.

¶ The Action of Medicines in the System, 3rd Edition, 1859.

blood, as the product of secondary textural mal-assimilation; for chemical research has failed to discover any abnormal quantity of this acid in rheumatic blood. And this fact equally tells against the supposition of its accumulation by primary mal-assimilation, or by suppressed excretion of the perspiration.

Nor does *uric* acid superabound in rheumatic blood. Garrod's chemical analyses\* establish this negative fact. In truth, rheumatic blood is decidedly alkaline.†

*Treatment.—Preventive.*—The essential morbid condition—which, in those subject to rheumatism, is ever in operation as the cause predisposing thereto—being unknown, the evolution of rheumatic symptoms, from time to time, cannot be averted; and as if to show how comparatively unimportant, apart from this knowledge, is that of knowing the exciting and reputed cause of rheumatism, it is useless to avoid exposure to cold, for that alone will never evoke the disease, and if the blood be charged with the unknown poison, it will arise spontaneously.

*Curative Treatment.*—The same want of exact knowledge as to the nature of the rheumatic blood-poison, renders our remedial measures proportionately aimless. Whatever it be, there is probably—as with other blood-poisons—a natural tendency to elimination from the system by one or more of the excretory organs. Hence, it is not surprising, that experience should sanction the employment of medicines affecting the liver, and intestinal canal, the kidneys and skin.

In *acute* rheumatism—with high inflammatory fever—it may be necessary, in the first place, to reduce the general circulation by systemic blood-letting, venesection. Usually, however, a cholagogue dose of calomel, and an aperient saline, will prove sufficiently depletory, and remove also any source of irritation from the intestinal canal. But such measures are preliminary only. Then, the colchicum and alkaline treatment, is generally the most effectually anti-rheumatic. Bicarbonate of potash, in large doses—two scruples or half a drachm, combined with the wine of colchicum in doses of ten or twenty minims; may be administered every four hours. The joint-affections may thus subside within an average period of ten days, and the urine becomes alkaline. Sometimes the colchicum producing sickness and purging, it must be discontinued, or moderated; but it is desirable to keep the urine alkaline for two or three days after the joint-symptoms have subsided. This plan of treatment is certainly successful in many cases. In proportion as *synovial* symptoms predominate, or mix themselves distinctly with the fibrous—observes Sir Thomas Watson—in proportion as the disease approaches in its characters to gout, you may expect to be successful with *colchicum*. Dr. Garrod, who originated the *potash*-treatment in large doses, affirms that it greatly diminishes the tendency to pericarditis and endocarditis. Nitrate of potash—still in large quantity, half an ounce to three ounces a day—is the favourite salt with some practitioners; acetate of potash with others. The late Dr. Golding Bird trusted to the latter, given in quantities of half an ounce, much diluted, in divided doses, during the twenty-four hours. In three days only, it has been known to overcome the pain and inflammation, leaving the joints still swollen but placid. Iodide of potassium finds favour with yet other men of experience, surgeons chiefly,

\* Med.-Chir. Trans., vol. xxxvii., 1854.

† Ibid.



and lemon-juice has been advocated by Dr. Cwen Rees. Both the latter agents answer better in the *less* acute form of rheumatism. All these agents are probably eliminative, principally through the kidneys.

Calomel and opium, quickly pushed to slight salivation, is another plan of treatment. It would seem to be preferable in cases having a tendency to cardiac inflammation. Opium is, perhaps, most remedial in all cases of acute *fibrous* rheumatism. Sir Dominic Corrigan has great confidence in its efficacy. Beginning with one grain, repeated at short intervals in the twenty-four hours, he gradually increases the quantity up to an average of twelve grains during that period; and continues it until the disease declines.

In *chronic* rheumatism; the compound powder of ipecacuanha (Dover's Powder), guaiacum, and sarsaparilla, have reputed efficacy. It would be useless to extend the list. The general nature of the treatment of this disease,—acute and chronic, may be gathered from the foregoing observations.

*Local* treatment can scarcely be of any avail for a disease which, apparently, naturally expends itself by inflammation of whatever part or parts may become affected. Assuredly no repressive application can be salutary. Warm fomentations are calculated to lead the inflammation, as in all other cases, to an issue by resolution. Alkaline fomentations, and especially with an alkaline and opiate solution, are found to be even more conducive to this termination. Dr. Fuller, who strongly advocates such an application, usually employs a solution of carbonate of potash or soda, about half an ounce, in nine ounces of hot water, adding six drachms of liquor opii sedativus. Flannel steeped in this hot lotion is wrapped round the inflamed joints, and then encased with thin gutta-percha. Chronic rheumatism, attended with thickening and stiffness of the joints and fasciæ, may be somewhat ameliorated by warm baths, vapour baths, shampooing, or frictions. The Turkish bath will thus prove beneficial, provided there be no heart affection of consequence.

### GOUT.

GOUT is a blood-disease allied to rheumatism, but differing in its pathology and treatment.

*General Symptoms and Diagnosis.*—This disease is manifested by an inflammation affecting the joints, very commonly the first joint, or *ball*, of the great toe.

Commencing, usually, when the individual about to suffer has retired to rest, and has enjoyed some hours perhaps of sleep, he is awoken with fixed pain in one of his feet,—mostly, as I have said, in the ball of the great toe, but sometimes affecting the heel, instep, or ankle. With this pain, cold shivering is generally experienced, succeeded by heat, as the pain—boring, grinding, and wrenching—fastens more and yet more firmly on the spot of its election. “Place your joint in a vice,” said a witty Frenchman, “and screw the instrument up until you can endure it no longer. That will represent rheumatism. Then give another twist, and you will somewhat realize gout.” The skin over this part is acutely tender, red, tense, and shining, encircled by some œdema, and by converging turgid veins. Much restlessness and excitement supervene. In vain the sufferer seeks to relieve himself of the weight of his bedclothes upon the part inflamed; in vain he shifts his foot from place to place in search of



a cool and easy position. The pain, remorseless, grapples yet more tightly. At length, in the course of twenty-four hours or so, it loosens its hold gradually, perhaps suddenly. The sleepless excitement also then subsides, and the victim enjoys some temporary repose. He wakes again to undergo punishment. The toe-screw is reapplied, it may be with a turn or two less; and day by day a slighter punishment is inflicted, until at length the full penalty has been paid. The cuticle peels off the part affected, for gouty inflammation ends by resolution; it never terminates by the effusion of plastic lymph, suppuration, or gangrene. In these respects, this inflammation and that of rheumatism concur.

Eventually, after frequent attacks of gouty inflammation, the cellular texture around the joint usually becomes pervaded with a deposit of urate of soda, forming concretions, at first pulaceous, then "chalk-stones," of perhaps considerable size. The nodular fingers and toes of chronic gout is a matter of common observation. The skin over these nodules being stretched, at length breaks, and the chalky concretions are laid bare. Urate of soda has been found infiltrating all the textures of one or several joints, in synovial membrane, cartilage, the heads of bone, and ligaments; and usurping their place, the articulations are irreparably destroyed.\*

*Constitutional Disorder.*—Does any characteristic—*i.e.*, peculiar and constant, constitutional disturbance—precede and accompany an attack of gout? Yes, verily—and its *premonitory* symptoms refer to the functions of the stomach and kidneys, more especially. Dyspepsia, denoted by inappetency, eructations, heartburn, and acidity of the saliva; together with scanty urine, clear, high-coloured, and containing *less* than the average amount of *uric acid* or none at all; these symptoms portend a fit of the gout. An intolerable lowness of spirits, with general restlessness and peevishness are not unfrequently premonitory.

*Blood-origin.*—Chemical analysis demonstrates the presence of an *excess* of *uric acid*, with no other change, in the blood. It is, therefore, scarcely necessary to even glance at those characters in the history of gout which might otherwise be appealed to in support of its being a blood-manifestation. The absolute test of "blood-disease" having been supplied in this instance directly (by chemical analysis), supersedes the occasion of any other evidence. But I might point to facts such as these:—Gout visits "many textures" and parts of the body "simultaneously" or in "succession."

*Blood-pathology*—The blood superabounds with uric acid; but its normal constituents apparently are not modified. "It is," writes Dr. Garrod,† "by the augmentation of those principles which exist in health, in such minute traces as to be detected with difficulty, that the peculiar alteration of the blood in this disease is manifested. The blood in gout always contains uric acid in abnormal quantities and in the form of urate of soda, which salt can be obtained from it in a crystalline state."‡ It arises apparently, from mal-assimilation,—primarily, of albuminous food in the course of digestion, or secondarily, in the metamorphosis of muscular texture. Or, it may denote simply an excess of animal food over the wants of the system. And the fact first disclosed by Garrod's analyses

\* Diseases of the Joints, 1850, 5th Ed., Sir B. C. Brodie.

† The Nature and Treatment of Gout and Rheumatic Gout, 1859.

‡ Trans. Med.-Chir. Soc., 1848.

of the blood, coupled with the known phenomena of arthritic inflammation, inducing the formation of urate of soda concretions, and abundant deposit of urates in the urine; constitute a series of facts, which plainly declare the pathology of this disease. An attack of gout is an effort of nature—of the restorative power—to expel a poison, uric acid, from the blood. Sir Thomas Watson well describes this struggle. “Morbific matter (it may well be called a *poison*) is generated, or detained, under certain circumstances, within the body, and silently collects, in the blood; until, after obscure threats, perhaps, and prelusive mutterings, it explodes in the foot; and then the bodily economy, like the atmosphere after a thunder-storm, is for a while unusually pure and tranquil.”

Or, gout may engage many joints at once, or flit from one to another; or wander about, disturbing the heart, the lungs, and the brain. Hence palpitation and syncope, dyspnœa, disturbed vision and hearing, with cerebral commotion, bordering on apoplexy and paralysis. This is known as *irregular*, lurking, or masked gout. Sometimes, however, having settled in the foot, it suddenly disappears, and migrates to the stomach, heart, or brain; *retrocedent* gout as it is then called, being unlike the retreat of an ordinary foe—an assault on the very fortress of life. Less perilous migrations are witnessed, when gout betakes itself to the urethra, occasioning a scalding discharge; to the testicle, constituting one form of orchitis; to the eye, giving rise to ophthalmia.

All these manifestations of irregular and migratory gout should be borne in mind, otherwise, the disease in some form might be overlooked.

In whatever shape gout may have appeared, whether regular, disguised, or migratory, its decline is marked and measured by a flow of urine, surcharged with uric acid,\* thus relieving its accumulation in the blood.

*Detection of Uric Acid in the Blood.*—The ready method proposed and practised by Dr. Garrod for this purpose, and for which the abstraction of only a very small quantity of blood is requisite, he thus describes as the “uric acid thread experiment;”†—

“Take from one to two fluid drachms of the serum of blood, and put it into a flattened glass dish or capsule; those I prefer are about three inches in diameter, and one-third of an inch in depth: to this add ordinary strong acetic acid, in the proportion of six minims to each fluid drachm of serum, which usually causes the evolution of a few bubbles of gas. When the fluids are well mixed, introduce a very fine thread, consisting of from one to three ultimate fibres, about an inch in length, from a piece of unwashed huckaback, or other linen fabric, which should be depressed by means of a small rod, as a probe or point of a pencil. The glass should then be put aside in a moderately warm place until the serum is quite set and almost dry; the mantel-piece in a room of the ordinary temperature, or a book-case, answers very well, the time varying from twenty-four to forty-eight hours, depending on the warmth and dryness of the atmosphere.

“Should uric acid be present in the serum in quantity above a certain small amount, noticed below (*vide* Work), it will crystallize, and during its crystallization will be attracted to the thread, and assume forms not unlike that presented by sugar-candy on a string. This may then be examined

\* The characters of the urine in this, and other morbid conditions, are described in the ‘Urinary Pathology and Deposits’ of the Author’s Work on the “Irritable Bladder,” 2nd Edit., 1867.

† Op. cit., 1859.

by a linear magnifying power of about fifty or sixty, procured with an inch object-glass and low eye-piece, or a single lens of one-sixth of an inch focus answers perfectly. The uric acid is found in *rhombs*, the size of the crystals varying with the rapidity with which the drying of the serum has been effected and the quantity of uric acid in the blood." To ensure perfect success in this experiment, several precautions are necessary, for which the reader is referred to Garrod's Work, pp. 111-113.

An amount of uric acid equal to at least 0.025 grains in 1000 grains of serum, in addition to the trace existing in health, must accumulate before this experiment gives indication of its presence. *Premonitory* symptoms, however, coupled perhaps with the signal given by this test, announce that gout is impending.

*Hygienic Causes.*—Certain habits of life predispose to gout, and certain other habits of an opposite character have an opposite tendency. Indulgence in animal food more particularly, and stimulating drinks; generally, in point of fact, what is called "rich living," together with a sedentary, idle life; these are the acknowledged parents of gout; while moderation in the "pleasures of the table," even abstinence, with a life of active exercise, has no such offspring. Luxury and ease have long since been mistrusted as unqualified advantages compared with the apparent hardships of daily bread, earned by daily labour; so much so, that Abernethy's pithy advice, "Live on sixpence a day, and earn it,"—pointing, as it does, to the two elements, food and exertion, in relation to gout—has passed into a proverb.

*Treatment.—Preventive.*—The regulation of diet by exercise—of bodily supply by expenditure—is the preventive measure furnished by *experience*. But experience is insufficient for practical purposes. It affords no clue to the right understanding of the physiological relation subsisting between food and exercise, nor of the pathological relation between these hygienic requirements which determines the rational prevention of gout. It is the peculiar province of Science to supply the interpretation and elucidate the significance of facts. Knowledge thus becomes appreciated, and applied because appreciated.

Physiological Chemistry having first demonstrated the fact that all kinds of animal food, more especially, furnish uric acid in their transit through the body, by indigestion, or by metamorphosis of the muscular textures; it became obvious that the balance between the production and elimination of uric acid can alone be adjusted and regulated by a supply of animal food in proportion to its waste by bodily exercise.

Then Chemical Pathology contributed the additional and complemental fact, that uric acid existing as urate of soda in abnormal *excess* in the blood, is the *materies morbi* of gout. Obviously, therefore, the preventive measure which should be directed against such accumulation is this:—*To allow only that particular amount of animal food which, with daily exercise in proportion, will preserve the blood free from uric acid, short of the trace existing in health.*

Now this goes a step beyond mere experience. Guided by an exact knowledge of the *essential* morbid blood-condition from whence proceed all the phenomena of gout, we are enabled so to regulate the health as to prevent this disease. Exact information of the blood-condition, respecting any individual in question, can be readily obtained by abstracting a very small quantity of blood for analysis, or by examining the serum exuded under the application of a blister.



Moreover, by this *scientific* knowledge we are led to rationally administer certain medicines in aid of our hygienic preventive measures. Alkalies—of which the bicarbonate of potash is perhaps the most efficacious for prolonged use—may be administered daily, to neutralize any fresh accession of acid; and colchicum, as a diuretic, will aid the elimination of urate of soda by the kidneys. The mineral waters of Vichy, Wiesbaden, and other places of known repute, owe their virtue chiefly to similar qualities; but in speaking of the *principle* of prevention, I need not enter further into detail.

To illustrate the prophylactic management of gout, Dr. Garrod relates a case, on the authority of Sir H. Halford, in which colchicum with quinine taken in moderate doses daily, gave immunity for two years, when previously scarcely two months elapsed without an attack.

*Curative Treatment.*—Having due regard to the origin of the blood-disease,—by mal-assimilation, primarily or secondarily; hygienic measures are also curatively important. A reduced proportion of animal food is obviously the leading curative measure, and active exercise daily to increase the elimination of any excess is equally necessary.

No remedial measures are at present known for directly correcting mal-assimilation in respect to lithic acid or other products. The effect of increased bodily exercise may be to increase the destructive metamorphosis of the highly nitrogenous textures—*i.e.*, muscle, and thus directly increase the production of lithic acid: but this may also react beneficially in subsequently correcting the mal-assimilation.

Lithic acid passing off in the urine as lithate of ammonia is liable to be decomposed by the action of any free acid present in the urine; and lithic acid itself being insoluble appears as a deposit of reddish-yellow sand, consisting of crystals, which may aggregate and form a calculus. Hence the administration of alkalies to neutralize the acidity of the urine is indicated, of which bicarbonate of potash is, perhaps, the best for oft-repeated use. Other alkalies employed for this purpose are the bicarbonate of soda (“Vichy water”) the acetates, tartrates, and citrates of soda and potash, phosphates of soda and ammonia, and borates of soda and potash. Conversely, the removal of any source of acidity is also indicated; but this refers again to hygienic considerations. With regard to food, the vegetable acids, or that which will form them, as sugar or starch in the food, should, in Dr. Bence Jones’ opinion, be prohibited. On the other hand, free perspiration to eliminate the acids of the sweat, the retention of which would precipitate uric acid in the urine, is scarcely less important. Warm clothing, warm bathing, friction with horse-hair gloves and belt, an excellent stimulant, and diaphoretics, are most efficacious.

Lithate of ammonia being soluble in urine at the temperature of the body, its solution is thus secured, provided only that fluid be not overcharged. Dilution of the urine will best prevent supersaturation and deposit. The free use of aqueous drinks or soda water, is calculated to fulfil this indication, and thus probably prevent the formation of a lithate of ammonia calculus.

Diuretics, which increase the secretion, will also aid the dilution, of urine, and, moreover, will tend to eliminate lithic acid or lithates, from the system. The wine of colchicum, in doses of ten minims and upwards three times a day, prescribed with the carbonate of potass to keep the lithic acid in combination, the resulting lithates themselves being further



held in solution by the administration of diluents—will together carry off both, and soothe the irritability of the bladder which accompanies their discharge. Salient aperients seem to contribute to this desirable result. Any prolonged subjection to such a course of elimination, requires also the simultaneous action of small doses of blue pill, apparently to maintain the proportional secretion of bile, which otherwise being virtually retained as compared with the secretion of urine, would disturb the balance of their constituents in the blood.

## DISEASES OF CONTAGIOUS ORIGIN.

### CHAPTER VII.

By the term Contagion, I mean the communication of disease by external contact, as distinguished from communication by inhalation or infection. The disease produced is not necessarily constitutional, but possibly merely a local affection; for example, Itch, as contrasted with secondary or constitutional syphilis.

Still, under the same general heading may be associated certain remarkable species of blood-disease, which have severally received names of various kinds. Syphilis, Erysipelas, Pyæmia, Hospital Gangrene, Hydrophobia, Snake-bites, Malignant Pustule, and Glanders; are all naturally associated together as being contagious, or the offspring of contagion. But of these, the first four are derived from the *human* species, the remaining four from *animals*. This difference allows a corresponding division of the whole class.

#### SYPHILIS.

SYPHILIS is essentially a blood-disease, produced by the introduction of a virus or poison into the general circulation. But its introduction is attended by certain tolerably definite manifestations in the skin or mucous membrane, and proximate lymphatic glands, in the form of chancre and bubo respectively; constituting *local* or *primary* syphilis; while the consequent blood-disease is manifested by certain tolerably definite inflammatory modifications of nutrition in the skin, mucous membranes, eyes, testicle, periosteum, bones, and other parts—constituting *constitutional* or *secondary* syphilis. A concise description of this series of manifestations will lead to their diagnosis. How far *every* form of chancre and bubo, as local syphilis, may be *also* primary or *causative*, in relation to constitutional syphilis, itself necessarily secondary, will be duly considered subsequently.

LOCAL SYPHILIS.—(1) *Chancre, and its Diagnosis*.—Chancre is said to be a primary *syphilitic* sore or ulcer. Commencing at an uncertain period, possibly a month, but generally from three to five days, after infection; a trifling itching is experienced, affecting, usually, some spot in the furrow at the base of the glans penis, near the frænum, or it may be on the prepuce or the skin of the penis itself; there soon appears a small pimple, whose summit speedily becomes a vesicle, containing at first a thin transparent fluid lymph, gradually becoming thicker and opaque, in fact, purulent. If the syphilitic virus be introduced through a crack or abra-

sion, which may happen in the act of intercourse or have existed previously; the chancre forms as an ulcer, without any incipient pimple, vesicle and pustule; obviously because the cuticle there raised by secretion, was here removed. Otherwise, this papule, vesicle, and pustule, is alike the *typical* mode of origin of all chancres; yet how diversified their subsequent appearances, and how like those of ordinary ulcers. Their diagnosis is, perhaps, impossible. The granulating or healing sore alone excepted, we may recognise:—the simple syphilitic ulcer; the indolent and indurated; the irritable; the phagedænic; the inflamed; and the sloughing phagedænic.

When the pustule of an incipient chancre bursts, a “simple” ulcer is presented, without any special characters. It is a small circular cup-shaped cavity, having a smooth interior, without granulation, discharging a thin serous fluid, or glazed with a little adhesive lymph, and set in apparently healthy texture. This, the first of all primary syphilitic ulcers, may, however, about the end of the first week and never before the *third day*, become indurated, by effusion of plastic lymph beneath its base, and around. A single exception is observable in chancre on the glans penis, which never acquires induration; it is here simply a spot denuded of cuticle, and presents a red, moist, glistening, flat surface.

When “confined to the *base* of the ulcer,” such *induration*—elastic cartilaginous, and terminating abruptly—was regarded by Hunter\* as characteristic, and the specific diagnostic mark of true chancre. Yet Hunter himself acknowledged, in the sentence immediately preceding this, his definition, that the indurated base is not peculiar, being common to other indolent ulcers.

A slight modification, as it appears to me, of Hunter’s doctrine, has since been revived and advocated by M. Ricord,† who affirms that cartilaginous induration at the base, and *around*, a primary syphilitic ulcer, is absolutely *pathognomonic* of “infecting chancre,” or that species which accompanies and denotes constitutional syphilis. He regards this character as the local expression, by chancre, of the syphilitic blood-disease—in short, the first *secondary* symptom.

But precisely the same condition of induration may be produced artificially by irritating applications—*e.g.*, kali purum (Hennen), corrosive sublimate (Acton), and better still, says Ricord, by chromate of potash, or by nitrate of silver, the nitric and sulphuric acids; “so as to deceive even the most careful and experienced practitioners.” It was thus, for example, that Abernethy‡ was betrayed by an indurated sore, and recommended mercury to be rubbed in to salivation! Observing, however, that it produced no amendment, and ascertaining that the hardness had several times subsided and returned, an unirritating dressing was used, when the induration disappeared without the use of mercury.

Under other circumstances, pertaining rather to the state of the general health, and the condition of the digestive organs in particular, the primary ulcer becomes “irritable,” that is to say, painful and disposed to bleed easily. This, therefore cannot be considered a *specific* sore. Nor again is the “phagedænic” in any way characteristic. The same irregular worm-eaten sore, with sharp, undermined edges, may either be syphilitic, or proceed from the depraved constitutional condition by which a sore

\* Venereal Disease, edit. Home, 1810, p. 229.

† Lecture on Chancres, trans. C. F. Maunder, 1859.

‡ Surgical Observations, 1804, p. 135.

becomes phagedænic. Less characteristic is an obviously "inflamed" ulcer, and that mixed appearance known as "sloughing phagedæna." In short, the primary syphilitic ulcer may assume many characters, but none of them are *peculiar* to syphilis. Primary syphilis cannot thus be diagnosed with more than equivocal probability.

This *negative* result of observation is supported by the united testimony of all who during the present century have most patiently watched, in vain, to discover any characters whereby *chancre* can be surely distinguished. First:—Rose\* (1817), whose experience in the hospital of the Coldstream Guards ranged over a large number of cases, admitted that although there are many symptoms common to chancres, they are not entirely peculiar to them. Hennen† (1829) acknowledged with regret that there are "not any invariable characteristic symptoms by which to discriminate the real nature of the primary sore;" and, having witnessed many instances of self-deception, in attempting to diagnose a sore for the cure of which mercury is indispensable, from one of a different nature, he repudiated the pretensions of those who assume to themselves the possession of a "tactus eruditus" by which they can distinguish this kind of chancre. Recurring to the diagnosis of chancre, rather than the kind, Mr. Bacot's experience‡ (1829) led him to affirm, that chancre may present every variety of appearance to which a breach of surface is subject; and Colles§ (1837) stated, "as the result of long, attentive, and anxious observation," that primary venereal ulcers present an almost endless variety of character. To this effect also were the observations of Wallace|| (1838); for, says he, neither the mode of origin, nor the form, nor the colour, nor the size, nor the number of the ulcers of primary syphilis, are pathognomonic. Acton¶ (1851) avowed it was incontrovertible, that other sores, not of a specific nature, may assume all the aspect of real chancres; and Labatt\*\* (1858), considering the great variety of appearances presented by primary ulcers, experienced the difficulty of classifying them, and confessed that hitherto every such attempt had ended only in disappointment.

More recently (1860) Mr. H. Lee,†† recognises four varieties of Primary Syphilis—

First.—The inoculated part may become affected with the *adhesive* form of inflammation, in which lymph is poured out either in the substance or on the surface of the part.

Second.—The inoculated part may, within a few days of the application of the poison, be affected with *suppurative* inflammation.

Third.—The absorbents may assume an active share in the morbid process, and taking up some of the infected parts, and with them portions of the syphilitic poison, produce an acute inflammation of a lymphatic gland. This form of the disease is termed *ulcerative* inflammation.

Fourth.—The morbid action may terminate in *mortification*. Of this there are two practical subdivisions:—

(a) Death of the whole infected part, which is then thrown off as a slough; (b) Dissolution and death of a part only of the contaminated structure, leaving a part still infected.

\* Med.-Chir. Trans. vol. viii. p. 358.

† Milit. Surg., 1829, p. 525.

‡ Treatise on Syphilis, 1829, p. 149.

§ Prac. Obs. on Venereal Disease, 1837, p. 75. || On Venereal Disease, 1838, p. 84.

¶ Diseases of the Urinary and Generative Organs, 1851, p. 380.

\*\* Obs. on Venereal Diseases, 1858, p. 48.

†† System of Surgery, ed. T. Holmes, vol. i.



*Situation.*—The external parts of the *genital* organs are obviously the common situation of chancre, and some parts are more especially liable. Thus, in the *male*, that portion of the penis is commonly the seat of chancre, which having been exposed in sexual intercourse, is apt to retain any secretion with which it came in contact. Hence, the furrow between the glans and prepuce, and perhaps near the frænum is the most frequent situation; but chancre may form on the inner surface, or at the margin of the prepuce, or on the frænum; sometimes on the glans, or at the orifice of the urethra, or perchance on the skin of the penis. *Urethral* chancre is, however, not unfrequently met with; the chancre being situated immediately within the orifice of the urethra, or higher up in the canal. In the one case, it may easily be seen on just everting the lips of the urethral aperture; in the other case, it can be felt as a more or less nodulated induration of the urethra when pressed between the thumb and finger. Chancres thus situated have been found by Ricord to extend along the whole canal up to the bladder, in rare cases. Urethral chancre emitting its discharge from the external orifice, may be mistaken for gonorrhœa; but, while their diagnosis cannot be determined by the variable appearance of the discharge, inoculation will evince its true nature; a chancre being produced if the matter be syphilitic, and not by gonorrhœal discharge. The presence of a nodulated induration in the urethra will corroborate the diagnosis.

In the *female*, also, the external genitals are the common situation of chancre, as just within the labia minora; less frequently on the mucous membrane of the vagina, or on the os uteri or within the cervix. Examination will readily discover a chancre when situated externally; but, the speculum must be used to detect the presence of a vaginal or uterine chancre. In certain *unnatural* situations, chancre may occasionally be found; as at the anus, or on the lips of the mouth; suspicions of practices which need not be named.

(2) *Bubo and its Diagnosis.*—What is *syphilitic* bubo? Perchance its physical characters may be more uniform and peculiar, although available only at a later period than those of chancre, to guide our diagnosis.

Now it is alleged that bubo denotes absorption of the syphilitic virus from the primary sore, which, on its way to the blood, through the absorbents, irritates the absorbent glands, whereby they become swollen and hard, and perhaps suppurate. Compared with chancre, bubo can scarcely be called a *primary* symptom, for although the time of its accession after chancre is uncertain, it is always somewhat *later*. In many cases bubo *never* supervenes, the syphilitic virus apparently passing on uninterruptedly to the blood, without any demonstration during its journey, as if a highway robber should overleap a toll-bar without paying the customary toll.

This uncertainty respecting the formation of bubo, and delay in its coming, seriously impair its diagnostic value. On the other hand, bubo may possibly, although not probably, occur without previous chancre. Bubo may be the only primary symptom. Such buboes therefore have been named "primary buboes," and by the French "*bubons d'emblée*." Delpech, Sir A. Cooper, and many others deny their existence; whereas Fallopius, Hunter, Wallace, Lagneau, Swediaur, Bertrande, E. Wilson, and other authorities affirm that they do occur.



As being possibly the *only* primary symptom present, the question presses—are there any characters whereby *syphilitic* bubo can be assuredly identified? If no peculiar characters distinguish it, then bubo, no less than chancre, alone considered, is equivocal evidence in our diagnosis of primary syphilis.

Firstly.—There is the possibility of bubo arising from irritation of the lymphatics, in some part more or less remote; the irritation having apparently been propagated along the course of the absorbents leading to the swollen glands, without, however, any poisonous matter having been absorbed. The femoral glands becoming enlarged from the irritation of a chafed toe is a familiar illustration. This *sympathetic* bubo is easily distinguished by the kind of local cause in operation.

Secondly.—But if swelling of the lymphatic glands exist alone, unaccompanied and not preceded by any kind of sore, in any situation; then, is it possible to pronounce *that* swelling a syphilitic bubo?

Many species of bubo are attributed to syphilis, yet they all appear to be one and the same kind in different stages of progressive inflammation. Beginning as a hard and somewhat painful swelling of the lymphatic gland usually nearest to the spot whence the poison is absorbed; the absorbents themselves proceeding to the enlarged gland, share this inflammatory induration, and sometimes feel like hard whipcord. Along the back of the penis such cords may be felt leading to the groin, where mostly, just above Poupart's ligament, lies the swollen gland. Or, in the female, if a chancre be situated anteriorly on the vulva, this swelling is discovered at the external abdominal aperture; and if situated posteriorly, then betwixt the labium and the thigh, inflamed lymphatic vessels lead to a swollen hard gland in the groin. Occasionally bubo is situated elsewhere, when the vessels of absorption pass through other than the inguinal glands. Hunter saw a syphilitic bubo far down on the thigh; and he met with other instances on the lower part of the abdomen.

Wherever placed, as the gland enlarges it successively engages the surrounding cellular tissue and skin; the latter becoming inflamed and adherent, fixes the tumour. Suppuration *may* ensue. The skin acquires a stretched and shiny appearance, while the cuticle desquamates in receding circles, and the cutis becomes thinner. At some point fluctuation can be felt, the thin skin cracks, matter is discharged, and a cavity exposed that speedily assumes the condition of an ulcer.

Up to this point, the most critical observer could detect nothing to characterize the swelling syphilitic bubo, beyond the fact of its association with a sore, the nature of which, however, is itself doubtful; less certain, therefore, would the diagnosis be were bubo present alone. Carmichael\* acknowledges his inability, before ulceration, to determine whether bubo be syphilitic or not; and if the former, what *degree* of venereal disease; but that when ulceration takes place, the bubo partakes of the same mildness, or malignity, as the primary ulcer from which it originated. Yet these signs are equivocal, for, like chancre, the ulcer of an open bubo at once acquires all the characters of some kind of *common* ulcer; it may be the indurated and indolent, the irritable, phagedænic, inflamed, sloughing phagedænic. The size of this ulcer, of course, varies; usually not larger than the bubo itself, occasionally, and fortunately but seldom, it becomes enormous, extending inwards over the perinæum, or

\* Clin. Lectures on Venereal Diseases, 1842, p. 109.

downwards over the thigh, or upwards, perhaps, as high as the navel, while its depth may threaten the femoral artery.

Now all this—the origin and progress of an inguinal bubo—does not pronounce it syphilitic. Alone, its physical characters are fallacious—association with a sore elsewhere, the nature of which, as determined by its physical characters, is doubtful, renders the evidence only probable in some degree. Is there any *pathognomonic* sign or test which converts this indefinite probability into certainty?

*Inoculation.*—Does *Inoculation* supply the requisite test? The pus from a chancre, or bubo, being introduced beneath the skin of any part by a lancet charged therewith, produces a chancre. Thence in like manner another may be produced: first a pimple, then a pustule, then an ulcer. This power of reproduction was known to and used by Hunter. Mr. Lee affirms that inoculation, as a rule, is of no value in determining the nature of an infecting sore. That supposed instances to the contrary, as adduced by Dr. Sperino, were simply suppurating sores, with some amount of accompanying induration. But that out of 100 instances of indurated chancre, in one case only did inoculation succeed upon the patient who had the disease. On the other hand, Evans, Bell, Sperino, and other observers have alike insisted on the value of this reproductive test, and Ricord himself, who almost accords to “induration,” the rank of a pathognomonic sign of the “infecting chancre,” nevertheless regarding chancre as a distinct *species* of ulcer; acknowledges that its individuality “exists neither in its form nor in its floor, nor in an absolute manner in any one of its external characters. Its nature is in the pus which it secretes. Inoculation is the pathognomonic character of chancre, and which *alone* suffices to establish the diagnosis.”\*

Here then is an infallible test of *chancre*—the nature of its pus, as manifested by its inherent power to reproduce a similar ulcer—offspring and parent being alike, if under the same constitutional influence; and the offspring—chancre—inherits the power of propagation.

This method of diagnosis acquires a critical value from the fact established by Ricord, that the intensity of the constitutional manifestations about to ensue, cannot be measured by the number of chancres present simultaneously. Inoculation from a single chancre assuredly foretells any measure of constitutional perturbation; it is the brand of syphilis.

Then again, the power of reproduction is *inborn* in chancre, and available, therefore, as the test of chancre from the very first formation of lymph, when the chancre is yet a vesicular or pustular pimple. Inoculation is the *earliest*, as well as the most infallible, criterion of chancre. Thus also it contrasts favourably with induration, which is otherwise the most characteristic symptom, but which, in Ricord's experience, never precedes the ulceration; that generally towards the end of the first week following the infecting coitus, the induration manifests itself, and in the second week it becomes developed; but that while its development is rarely delayed until the third week, it is never met with earlier than the *third day*. The diagnostic advantage of inoculation, in point of timeliness, is apparently conceded by Mr. Lee; who thus qualifies his otherwise absolute rejection of this method of diagnosis. “A sore affected with the specific adhesive inflammation, will—he observes—yield a secretion capable of being inoculated during its *earliest* stage, before its specific

\* Op. cit.

action upon the patient's constitution has been developed, and the result of that inoculation may be a specific hardened sore accurately resembling the original. As soon as the specific adhesive inflammation has once taken place in a patient, his system is no longer in the same condition as before; he is no longer capable of being inoculated in the same way, and the inoculation, if attempted, in the vast majority of instances, entirely fails."

The bearing of all these considerations, on the treatment of chancre in relation to the prevention of constitutional syphilis, is obvious, and will have its practical application when I come to that branch of the subject.

What if this method of diagnosis, and the appropriate preventive treatment of constitutional syphilis, be postponed to a *later* period? Even then the open suppurating *bubo*, if present, is a chancre, and its pus will produce another chancre by inoculation. Not the pus secreted in the cellular tissue round about the suppurating gland, but that issuing from the gland. Here, then, is an *additional* test. We overtake the specific pus on its way to the blood, and possibly in time to anticipate its poisonous effects. Mere gonorrhœal bubo, or sympathetic bubo, arising from any irritation, does not yield specific pus; and the only question affecting the value of diagnosis by inoculation from bubo, is whether it affords a sufficiently early indication for the effectual employment of preventive measures.

Ricord observed that bubo, however large, which has arisen from a chancre when about to heal, is simply a swelling of the gland, and fails to supply virulent matter. The poisonous pus hitherto secreted by the chancre, was transmitted quietly through the absorbing lymphatics, without occasioning any outbreak in the glands; and now that they do offer some resistance, as it were, the pus still transmitted from the chancre is no longer specific.

But up to this time the *chancre* itself continues available for inoculation. The period of "*statu quo specific*" extends to when the ulcer cleanses itself, begins to throw out healthy granulations, and to cicatrize from its circumference. The duration of this period is considerable—frequently weeks, sometimes months; as long, therefore, as a chancre can be expected to continue without the supervention of constitutional syphilis, rendering any anticipatory diagnosis useless. In August, 1860, I had under my care a female patient in the Royal Free Hospital, who had previously an eruption on her skin, had then an ulcerated throat, and whose eyes presented, each, around the iris, a red zone bordering on iritis; yet with this train of secondary symptoms, two *specific* pus-secreting chancres still remained—one on either labium; and these, the patient stated, she acquired in December, 1859! No other chancres were present, nor were there any vestiges of others having been; and indeed, judging from her course of life since the time mentioned, when she was received back to a respectable home, it is probable that no sexual intercourse has since taken place. On this assumption these two chancres have continued specific during a period approaching *eight months*. Ricord maintains that the soft chancre, or that which he terms non-infecting, in a constitutional sense, mostly cicatrizes in the course of a few weeks; not unfrequently, however, the period of repair is prolonged much beyond; and that this form of chancre persists in preserving its virulent specificity almost up to the last moment of its existence; while, indeed, cicatrization



is proceeding at the circumference, the pus is specific in the centre of the ulcer; on the other hand, "the infecting chancre once developed, is not slow to limit itself, rapidly attains the period of *specific statu quo*, and passes with equal rapidity to the period of cicatrization."\*

The case I have adduced is apparently one exception at least to the invariability of M. Ricord's dictum, and the records of other observers are, I think, opposed to it. Of course the influence of different modes of therapeutic treatment must be taken into account; and of all differences in this respect affecting the results of statistics, the *mercurial* and *non-mercurial* treatment are the most influential. Subject thereto, I must allow that *some* of Rose's† well-marked indurated, or infecting chancres of Ricord—which were treated without mercury—conformed to the law laid down by the latter authority; they rapidly lost their specificity, for they rapidly healed. But such evidence of the short duration of the specific pus-forming power of this chancre is overruled by the history of thousands of other cases. Guthrie narrates cases treated without mercury, where the specific period, as measured by the chancre not healing, extended over six, eight, ten, and in one case twenty-six weeks. To the same effect are the very numerous cases endorsed by Sir James M'Grigor and Sir William Franklin.‡ In 1940 chancres taken indiscriminately, and which healed without mercury, the average period was, without bubo, twenty-one days, with bubo, forty-five days; and in 2827 chancres, including a larger proportion of indurated sores treated with mercury, the average period for healing was, without bubo, thirty-three days, with bubo, fifty days; (being a difference, I may remark, adverse to the generally supposed efficacy of mercurial treatment).

During a *long* period, then, extending to weeks or months, chancre retains its specific pus-forming power; and co-extensive therewith the inoculation test is available, so as to authorize our employing preventive measures against Constitutional Syphilis further than by local treatment, which is successful only when used during the first four days after the birth of chancre. And the *slow healing* power of a supposed chancre is itself corroborative proof of its nature. This character—signified by the absence of granulations—was long since observed by Hunter, and recognised by Colles,§ as a prominent feature in his definition of true chancre.

A self-reproducing and slow, perhaps very slow, healing sore or ulcer, is, in point of fact, a chancre; and while the latter character corroborates our exact diagnosis, it also provides a sufficiently early opportunity for the employment of certain preventive measures, after the first opportunity has passed away, in relation to Constitutional Syphilis.

What *its* manifestations are, will next engage our attention.

#### CONSTITUTIONAL OR SECONDARY SYPHILIS.

The blood, having become infected, after the appearance of induration, in the course of a month or six weeks, or a longer period, a constitutional disturbance—the syphilitic fever—ensues, usually in some degree. A dry, hot skin, and furred tongue, are succeeded by weakness and pain in different parts, with gradually the wan sallowness of syphilitic cachexia.

But, with the *accession* of this fever, various inflammatory modifications of nutrition occur, in a tolerably regular order, in different parts of

\* Op. cit.

† Med.-Chir. Trans., vol. viii. p. 558.

‡ Milit. Surg., Hennen, 2nd ed., p. 545.

§ Pract. Obs. on the Venereal Disease, 1837, p. 75.



the body. As manifestations of the blood-disease in operation, they are "secondary" or even "tertiary" to the chancre and thence the bubo, which, proceeding from the original source of infection, constitute "primary" syphilis.

The slow-healing power of the primary sore, and of an open bubo, somewhat suggest the prevailing character of these secondary manifestations. From the first moment of the pus-forming pimple, the whole career of syphilis is one of *disintegration* of the tissues, with an abortive effort of the reparative power by plastic lymph-forming induration. Disintegration by desquamative or other destructive eruptions of the skin; disintegration, by corroding ulceration of the tonsils, tongue, lips, palate, and perhaps the nose; disintegration, by iritis, with molecular lymph; disintegration, by irreparable destruction of the texture of the testis; disintegration, by caries and necrosis. Premature baldness, fretting ulceration around the roots of the finger and toe-nails, and a wan cachectic pallor, bespeak the consummation of syphilitic decay.

Comparing Secondary Syphilis in all these various forms, with similar diseases arising from other causes; their resemblance is often remarkable, and their appearances differ rather in degree than in kind. Probably, therefore, none of the manifestations of constitutional syphilis, secondary symptoms, are singly characteristic; but a concurrence—coterminously or consecutively—of such symptoms, may be diagnostic.

The descriptions given in Mr. Lee's elaborate treatise—for instance—with regard to syphilitic eruptions, for the most part amply confirm this general proposition.

(1) *Skin-diseases*.—Similar eruptions—exanthematous or rashes, papular or pimples, tubercular, squamous or scaly, vesicular and pustular—arise alike, as manifestations of constitutional syphilis in the skin; and also under other circumstances.

*Roseola or rose-rash*.—The eruption which usually first succeeds the syphilitic fever, is of a rose-red colour, not raised above the surface of the skin, disappearing on pressure, and returning as soon as the pressure is removed. It arises in the form of more or less rounded patches, giving a mottled appearance to the skin; when examined closely, each patch is seen to be made up of a cluster of papillæ, more injected than natural. This eruption sometimes vanishes within a few days. If it persists, the papillæ forming each patch generally become visibly enlarged, and the colour of the eruption gradually changes to a copper hue. This colour is commonly present in all syphilitic eruptions which remain for any length of time without suppuration or ulceration; but it is not peculiar to (secondary) syphilitic eruptions, it is not *pathognomonic*. It is—observes Erasmus Wilson\*—commonly met with in chronic eruptions of other kinds; for example, in acne, and non-syphilitic eruptions often possess more of the dull and muddy copper colour which is generally supposed to be characteristic of syphilis, than syphilitic eruptions themselves. Moreover, when present in undoubtedly syphilitic skin-diseases, it does not supervene until their decline.

The eruptions which follow this first efflorescence on the skin, present a variety of appearances.

*Lichen*, a papular eruption.—The papillæ of the skin are enlarged separately, in the form of hard elevations having a copper-colour, which

\* Syphilis and Syphilitic Eruptions, 1852, pp. 60-64.

terminate by desquamation or resolution. These elevations may be scattered irregularly over the body, or collected together into groups.

*Tubercular eruption.*—Effusion of plastic lymph having taken place, it becomes organized, as in the papular eruption, but now in the form of small, and tense conical eminences, covered with a red shining cuticle; which gradually acquire a copper tint, and shed their shining silvery scales of cuticle. The tubercles may be scattered singly over the surface, or aggregated into groups.

*Lepra, a scaly eruption,* commences, like the mottled skin of roseola, by the injection of circular groups of papillæ. The papillæ are at first separate, but soon the whole circular patch becomes equally involved; an effusion takes place into the substance of the skin, which then presents a small flat elevation, the edges of which are sometimes raised higher than the centre. A copper colour, of a more or less decided hue, overspreads the eruption, but it is often partially masked by a thin layer of cuticle, which is shed in thin white shining scales, as in common lepra. Numerous patches, all perfectly circular, may form on any part of the body. Patches of syphilitic lepra sometimes much resemble flattened syphilitic tubercles.

*Psoriasis*—another *scaly eruption*—occurs in the form of oval or irregular patches, slightly elevated above the surface. They are not depressed in the centre, and are often traversed by cracks or fissures. A copper or brown colour is often observable, but covered with epithelial scales of various degrees of thickness. This disease is much more persistent than syphilitic lepra. It occurs on the palms of the hands and soles of the feet, or on any part of the body.

*Vesicular eruptions*—as manifestations of constitutional syphilis, are similar to, if not identical with, vesicular eruptions not of syphilitic origin. Thus, in point of their origin only, we recognise *syphilitic herpes*, *eczema*, and *pemphigus* or *pompholyx*. In all, an effusion of serous fluid raises the cuticle into vesicles, or blebs,—*bullæ*, which are simply large vesicles such as occur in the last named form of eruption. But the diagnostic characters of syphilitic vesicular eruptions, are even less peculiar than those of the eruptions already noticed.

*Pustular eruptions* constitute also an analogous class to the non-syphilitic. They, like eruptions generally, may arise from the transformation of other eruptions, in the course of syphilis. Thus, the papular may change into the vesicular, and this pass into pustular.

The proper pustular eruptions of syphilitic origin, are divided by Cazenave,\* into three kinds:

(a) *Psyraceous* pustules, which are either small and narrow, or of large size, elevated, and round. They have a hard base, and are surrounded by a copper-coloured areola. The pustules are of a dull reddish hue, and are developed in successive crops; presenting examples of the disease in its origin, maturity, and decline. Their progress is slow, and the accompanying inflammation moderate. In some cases, however, it destroys the true skin, and leaves a small, white, circular scar, depressed in the centre, and not larger than a pin's head. This form chiefly occurs on the face and forehead, where it somewhat resembles *acne rosacea*, but it may appear on every part of the surface. The pustules dry into a small greyish scab, which separating, may leave either a cicatrix or some injection of the skin.

On the limbs, *psyraceous* pustules are of the size of a lentil, but

\* Diseases of the Skin. (Burgess.)

slightly elevated above the surface, with a hard base; and they contain a very small quantity of yellowish-white matter, which presents a strong contrast to the copper-coloured elevation on which it rests. They are not followed by ulcers; a thin scab forms on them, which is succeeded by a scar, or sometimes by a livid discoloration, or a small chronic induration.

(b) *Impetigo*, preceded by slight malaise.—This eruption commences with redness of the affected parts; then small collections of purulent matter form irregular shaped patches, more or less confluent, resting upon surfaces of a coppery-red colour, which are soon covered by scabs irregular in shape, harder, darker coloured, and more adherent than those of non-syphilitic impetigo. Beneath these scabs are characteristic ulcerations, followed by scars, varying in shape and extent. This eruption more frequently occurs on the face, but it may affect any part of the surface. It sometimes appears on several parts simultaneously, but it has no tendency to spread. It is always secondary.

(c) *Ecthyma*.—The pustules are still larger,—the size of a shilling, or more isolated, and few in number; chiefly occurring on the limbs, and especially the legs. Commencing as large livid spots, the epidermis becomes raised over a considerable portion of each spot, by a greyish, sero-purulent matter, which increases slowly, and is always surrounded by a broad copper-coloured areola, unlike the violet-red of non-syphilitic ecthyma. After a few days, the pustules having broken, scabs form, which are of a circular shape, dark and hard; gradually increasing in thickness they fissure at their edges, and are very adherent and persistent. On separating, they expose deep round ulcers, with sharp-cut hard margins of a purple colour, whilst the bottom is greyish. They have little tendency to enlarge. The scabs generally re-form, and repeatedly, until the ulcers heal; leaving circular and lasting cicatrices.

This is the most common form of syphilitic pustular eruption, and that which usually occurs in new-born children. Here, the pustules are broad, superficial, flat, of an oval shape, and in great numbers; the scabs are dark and thick, and conceal small ulcers underneath. The countenance of the patient has quite a peculiar appearance; it is drawn in, and marked with numerous wrinkles, like that of an old person; the skin has an earthy hue, the body is emaciated, and exhales a most disagreeable odour.

*Ulceration of the Skin* in constitutional syphilis, may be either a sequel of some form of eruption, or it may arise independently; the syphilitic blood-disease always predisposing to disintegration of texture. But the characters of the ulcers just formed can scarcely be regarded as peculiar to syphilis. Ulceration of the skin in connexion with disease of bone about the skull, is specially noticed by Mr. Lee, with reference to its apparent cause—irritation—rather than as arising from the direct influence of the syphilitic poison. The importance of this diagnosis, in relation to the appropriate treatment, is obvious.

(2) *Diseases of Mucous Membranes*.—*Ulceration of the tonsils*.—"sore-throat"—ranks among the earlier and less equivocal secondary symptoms.

The ulcer formed is excavated, with a sharp and prominent, not to say everted, margin. The bed of this ulcer is sloughy, the surrounding mucous membrane dusky red. But even these appearances are not characteristic of syphilis, and original observers, such as Rose\* and Carmi.

\* Med.-Chir. Trans., vol. iii. p. 421.



chael\* concur in mistrusting "the ulcerated sore-throat." Certainly, the excavated ulcer of Hunter is not consequent on the indurated chancre only; and we must acknowledge, with Carmichael, that affections of the throat are too indistinct to afford any certain diagnosis.

Fissures of, and *milky stains* on, the tongue and inside the lips are more pathognomonic, but the former must be distinguished from those cracks which accompany irritable dyspepsia, and the latter—opaque white spots—resemble aphthous spots.

More doubtful are *mucous tubercles* situated on various parts of the buccal mucous membrane, as the tongue, lips, palate and tonsils. These tubercles are of a whitish colour, and may be seen also on the skin, in the form of pale, soft little cushions, bedewed with mucus; the skin surrounding each tubercle appearing puckered around its margin. Such tubercles—condylomata—are commonly found in secondary syphilis, grouped around the anus or on the scrotum; also, fretting along the margin of the external labia in the female; perhaps on the perinæum, inner aspect of the thighs, and on the groins. Sometimes these tubercles occur in the axillæ (E. Wilson); and, in fact, wherever ordinary tubercles are warm and moist, they frequently become mucous tubercles, skin readily assuming the appearance of mucous membrane.

But mucous tubercles are not necessarily syphilitic. Wilson notices† the transition of roseola into lichen, of the roseola eruption into such tubercles, and that the conversion of lichen into them is by no means uncommon; yet roseola and lichen are not necessarily syphilitic eruptions.

"Ulceration of the *nasal* mucous membrane, that of the hard and soft *palate*, of the *pharynx* opposite the mouth, and of the *larynx*," may ensue in secondary syphilis. These ulcerations are frequently accompanied with caries of the nasal bones, of the hard palate, even the vertebræ behind the pharynx, and necrosis of the laryngeal cartilages. The breath and discharges are singularly fœtid. Is any such ulceration peculiar to secondary syphilis? Colles‡ acknowledges his inability to determine whether an ulcer in the nose be venereal or not. The appearances of scrofulous ozæna closely resemble those of venereal ozæna. Colles describes an ulcerated opening situated on the septum nasi, about a quarter of an inch from its anterior extremity, this ulcer being uniformly circular, and as large as the surface of a split pea; but adds, that a similar aperture may be found in persons who certainly never had any venereal affection, and that it may remain for years, at least for eight or ten years, in cases under observation. Extensive ulceration of the pharynx, as well as ulceration of the nasal mucous membrane and caries of the nasal bones, were noticed by Carmichael to be frequently associated with the primary phagedænic ulcer, but that similar ulceration of the pharynx arises in constitutional conditions assuredly not venereal. Chronic laryngitis, and ulceration of the rima glottidis, denoted by a broken voice, impulsive cough and foul expectoration, may be a manifestation of advanced and grave secondary syphilis. Portions of the laryngeal cartilages—*e.g.*, the cornua of the thyroid cartilage, in an ossified state, are occasionally coughed up. Sir A. Cooper mentions these extreme cases, in his Lectures; but syphilitic laryngitis presents nothing peculiar in its characters, from first to last, whereby it can be distinguished

\* Essay on Venereal Diseases, 1825, p. 64.

† Op. cit.

‡ Pract. Obs. on the Venereal Disease, 1837, pp. 305-316.



from chronic laryngitis ensuing under other circumstances. The symptoms just mentioned might follow laryngitis, from a common cold.

(3) "*Syphilitic iritis*" was overlooked by Hunter, in his observations of the course of the venereal disease; but although undoubtedly a frequent form of secondary syphilis, it cannot be distinguished from arthritic iritis; and resembles scrofulous iritis, in so far as regards the appearance of the eye itself.

An elaborate work,\* which still retains its rank, states that in syphilitic iritis the eye presents tubercular depositions of lymph on the iris, a reddish-brown discoloration of the iris on its inner circle, and an angular disfiguration of the pupil, which is also occasionally displaced towards the root of the nose; and that these appearances, coupled with nocturnal exacerbations of pain, experienced in a much slighter degree, or not at all, during the day, are together sufficient to complete our diagnosis, corroborated as it is by the previous occurrence of syphilis, and in most instances the concomitant existence of other syphilitic symptoms. I shall presently notice the diagnostic value of contemporaneous and consecutive symptoms, respecting secondary syphilis; but how far trustworthy are the objective symptoms afforded by those appearances which the eye itself presents? The authority I have quoted himself retracts in part the diagnosis he has laid down; for, says he, "although the effusion of reddish, brownish, or brownish-yellow lymph on the iris in the adult, clearly shows the case to be venereal, I have seen analogous appearances in several instances, both of young children and infants, in whom no suspicion of syphilis could be entertained." The symptom in question is not peculiar to syphilitic iritis. Nor is "displacement of the pupil upwards and inwards" a characteristic appearance. It has been seen, especially by Mackenzie,† in chronic rheumatic arthritis; and still more frequently in scrofulous sclerotitis, without iritis. Moreover, it is present only occasionally in syphilitic iritis. This symptom, therefore, is inconstant as well as equivocal. Mackenzie mistrusts all the special symptoms accorded to syphilitic iritis, excepting the *tawny* or *rusty colour* of the iris near its pupillary edge, a condition present in most syphilitic cases, and almost exclusively in them alone.

(4) *Chronic enlargement of the testicle*, occurs late, if at all, in the course of syphilis, and cannot be distinguished from scrofulous enlargement of this organ. The physical characters which the testis assumes in these diseased conditions are very similar. In both cases, the enlargement may commence in the epididymis—sometimes in syphilitic, generally in scrofulous disease. In both cases, this swelling subsequently engages portions of the testis itself, the intervening portions remaining free and healthy; so that sometimes, by careful manipulation, *nodules* can be felt in the substance of the organ, through the tunica albuginea. At length the whole testicle becomes considerably enlarged, and feels hard and heavy. Then the scrotum may become inflamed and adherent, eventually undergoing ulceration, accompanied with protrusion of the testicle. In one such case, at the hospital, the whole scrotum was so much thickened and discoloured that I removed the testicle together with the portion of skin chiefly involved, rather than endeavour to save the organ by partial excision. On section, the appearances were those of a scrofulous testis. The epididymis was filled with a yellow friable matter, which, under the

\* Diseases of the Eye, W. Lawrence, 2nd Edit., 1841, p. 428.

† Diseases of the Eye, 4th edit., 1854, p. 543.

microscope, was seen to consist of imperfect broken cells and granules; while nodules of this substance were deposited here and there throughout the testicle, itself otherwise healthy, the reddish-grey colour of its tubuli seminiferi contrasting with the yellow nodules. The man bore the mark as of a chancre at the corona glandis, which he says occurred about two years ago, and that the testicle began to enlarge nine months prior to the operation. Judging merely from the condition of the organ itself, in this case, it would have been almost impossible to have pronounced its enlargement syphilitic; and, indeed, the most accurate diagnosticians have acknowledged the resemblance of scrofulous and syphilitic disease of the testicle. Under whatever circumstances chronic enlargement of the testis takes place, the symptoms are precisely the same, observes Sir B. Brodie.\* Dupuytren, also, was led to this conclusion by his observations.†

Simple *glandular* enlargement or hypertrophy, and atrophy, of the testicle, are also noticed by some authors.

The *absorbent glands*, in various parts of the body, are liable to become enlarged, and indurated enlargement of those, especially on the occiput and back of the neck, is regarded by Ricord, I believe, as diagnostic of secondary syphilis. But this condition is attributed, by other writers, only to disease of the parts in communication with such glands.

(5) *Diseases of the bones, periosteum, fasciæ, and ligaments* are possible manifestations of constitutional syphilis, advancing from the surface to deeper textures within the body; but this is a neutral ground, shared by the mercurial poison—prolonged mercurialization, by scrofula also, and by rheumatism. The question of venereal origin is open, therefore, in every case, to investigation, probably, afterwards to doubt.

A truly syphilitic *node*, for example, is usually considered to signify merely chronic enlargement of the bone itself. A hard swelling forms, without any redness of the skin in the first instance, nor subsequently for some time; eventually only it becomes red and acutely painful. Such nodes occur mostly in certain situations. The syphilitic virus appears to select certain bones or portions of bones for the production of nodes; they are mostly subcutaneous, as the inner aspect of the shaft of the tibia, the subcutaneous portion of the ulna, the sternum, clavicle, and cranium. These portions of bone more especially form nodes, which become inflamed. Nodes arising from periostitis are softer, and evidently inflamed from their commencement. They suddenly arise, and as suddenly subside.

These distinctions are true, and yet the hard chronic node is no criterion of secondary syphilis. This kind of node seldom, if ever, appears, excepting when mercury has been used, and coming, as it does, late in the career of syphilis, has perhaps been preceded by more than one salivation. Issuing from the mixture of mercury and syphilis, one cannot say how far a chronic node is due to one or the other. It is no sure indication of constitutional syphilis. Carmichael's experience led him to regard this symptom as "equivocal and uncertain." Colles notices "a general nodose affection of the bones," which is liable to be confounded with so-called syphilitic nodes, and he draws some distinctions.‡

*Caries* and *necrosis* are no less doubtful evidence of constitutional syphilis. Spongy softening of the bones, denoting caries, may happen in

\* Lond. Med. Gazette, vol. xiii. p. 221.

† Clin. Chi., t. i. p. 100.

‡ Op. cit., p. 185.

an advanced stage of secondary syphilis, and has its chosen seats; these being chiefly those where nodes are prone to form—on the tibia, ulna, clavicle, sternum, and above all, the nasal bones and cranium. But whatever bone or bones undergo carious softening, there is nothing characteristic of syphilis. Mercury as well as syphilis may be at work; and indeed we rarely, if ever, find caries in syphilitic cases, excepting where mercury has been freely used. None of the cases of syphilis which came under the observation of Guthrie,\* in the York Hospital, were accompanied with caries; and such was also the experience of Rose, in his series of cases,† upwards of a hundred and twenty in number, and where he was able to ascertain that the patients remained free from syphilis for many months afterwards, or if secondary symptoms returned, caries was not one of them. Necrosis, in constitutional syphilis, is equally often the offspring of mercury.

*Tertiary Symptoms.*—All the foregoing diseases can scarcely be designated secondary. Some of them, and more particularly disease of the testicle and of the bones, are *tertiary*, as compared with others previously described in the series. So also are certain ulcerations affecting the *nose*, *lips*, and *roots of the nails*.

A tubercular nodule may form on the ala of the nose. It is a hardened copper-coloured mass, varying in size from the eighth of an inch and more; persistent perhaps for many months, then ulcerating and destroying the nasal cartilages, and possibly extending further.

Cracks on either lip may appear, and remaining for weeks or months, ulcerate extensively.

Ulceration about the roots of the nails, onychia, may occur, having a brown or black colour, surrounded by a deep copper-red margin, and attended with a most offensive discharge. The fingers, toes, or both, though commonly the former, may be thus affected. In either case the ulceration is very obstinate, and the nails loosen, or fall off.

The *hair* may become dry, withered, and faded in colour; cracked or split at its extremities, and be shed or easily combed off, abundantly, even to baldness. If the bulbs are affected, the hair is not reproduced, and the baldness is permanent, a condition known as *alopecia*. It may be partial or entire; and affect the beard, eyebrows, and eyelashes. In one case, recorded by Vidal, the hair over the whole body came off.

Syphilitic diseases of *internal organs*, apparently consisting of lymph-deposits, are, doubtless, highly important in the history of Constitutional Syphilis; but their diagnosis is mostly obscure, and needs much further clinical investigation.

Lastly, a wan, yellowish hue, overshadows the skin in an advanced stage of the disease, which is designated the syphilitic *cachexia*; but this may denote a mercurial deterioration of the blood.

**HEREDITARY, CONGENITAL, INFANTILE SYPHILIS.**—The term infantile syphilis is not intended to signify primary syphilis in an infant, communicated at birth, from a primary sore or chancre existing in the person of the mother. The disease referred to is truly constitutional syphilis inborn, and transmitted as an hereditary infection, from the mother at the time of conception or during the period of intra-uterine life. But constitutional syphilis in the mother, in the father, or in both parents, is not necessarily transmitted to the offspring; who may indeed be singu-

\* Med.-Chir. Trans., vol. viii. p. 560.

† Ibid., p. 422.



larly free from any manifest constitutional syphilitic taint, or any other evidence of impaired constitutional vigour—as scrofula.

Syphilitic infection of the *ovum* appears so to lower its vitality, as to entail many morbid consequences. Abortion may ensue, at a variable period of pregnancy, the ovum never reaching maturity. Several consecutive miscarriages may thus take place, until the maternal or paternal state of infection is rectified or eradicated; when the mother will probably retain the fœtus for the full period of pregnancy—nine months, and then give birth to a living child. From the time of birth, the infant may exhibit symptoms of secondary syphilis, and present a cachectic, weakly, dwindled, and as it were, aged appearance. Or, free from any secondary symptoms at birth, they supervene in a variable period—a few weeks, commonly between the third and eighth week—or, perhaps, not until adult age.

The *mode of communication* would appear to take place in either of four ways, or in their combinations:—(1) From constitutional syphilis in the father, and without communicating any apparent infection to the mother; (2) from constitutional syphilis in the mother; (3) from both parents; (4) from systemic infection of the mother, through a primary sore—a chancre, contracted during pregnancy—the embryo having been quite healthy at the time of conception.

The important relation of these modes of transmitting syphilis to offspring, will be obvious, both in regard to treatment and to medico-legal inquiry.

Many other questions pertaining to hereditary syphilis, remain open to doubt, and are disputed. *Firstly*, whether a mother, pregnant with a syphilitic fœtus, the offspring of a father having the constitutional disease, can be infected through it without herself having had primary syphilis? Ricord answers this question in the affirmative, and the possibility of this mode of maternal infection, is supported by a large amount of evidence collected by Mr. J. Hutchinson. *Secondly*, whether a wet-nurse, having the constitutional disease, can infect the child she suckles, through the medium of the milk? Yes, says Ricord; no, says Acton. *Thirdly*, conversely, whether a syphilitic child can infect a healthy nurse? No, say Ricord and Acton. But Hunter and Lawrence relate cases in which several nurses have been thus infected, in succession; and two of whom transmitted the disease again to their own offspring. Evidence in support of the affirmative of both the two latter questions, may be found in “Ranking’s Half-yearly Abstract,” vol. iv. As to the mode of communication by suckling; any crack or abrasion on the nipple, or on the lip or mouth of the child, will facilitate the transmission. But, according to Dr. Colles, mere contact, without any excoriation, will suffice.

*Symptoms.*—Hereditary syphilis is not indicated by any peculiar symptoms. The cachectic, wasted, condition of the child, usually attracts attention. Secondary symptoms are manifested by the skin, and mucous membranes—especially of the nose and mouth. Congestion of, and offensive muco-purulent discharge from the *nasal* mucous membrane, are accompanied with a puffed appearance of the nose, and constant snuffling breathing, as a chronic catarrh, existing from birth, or soon supervening. The mouth exhibits spots of ulceration. *Cutaneous eruptions* appear, before birth—the infant presenting some such eruption from birth, or not until some weeks have elapsed—usually three or four. It appears in certain parts, more particularly; about the mouth, on the nates or



scrotum, or on the soles of the feet. Hence, observation should always be directed to these parts, in examining an infant supposed to be the victim of hereditary syphilis. The eruption may be recognised in the form either of flat, squamous tubercles, associated with maculæ or spots; or as vesicles or bullæ, which dry into scales or scabs. A brownish-red, coppery colour, of, or around these eruptions, is more characteristic. The *teeth*, both temporary and permanent, are affected; the latter with a specific and peculiar appearance. According to Mr. J. Hutchinson's original observations, certain carious, or ill-developed appearances are presented. The *temporary* teeth are cut early, have a bad colour, and are liable to a crumbling decay. The upper central incisors usually undergo this destructive change early, and always first; then follow the lateral incisors, which become carious and are shed; lastly, though rarely, the canine teeth wear away, so as to assume a flattened, tusk-like character. Owing to early decay of the incisors, the syphilitic child remains edentulous from an early period, in regard to these teeth, and has a remarkably unsightly appearance in the laugh of childhood, until the permanent ones are cut.

The *permanent* teeth, are more peculiarly affected; chiefly the upper incisors, and first the central ones. They are discoloured, short, peggy, rounded at the angles; standing apart with interspaces, or converging; and marked, on their margin, with a deep broad notch. They readily disintegrate, crumble, and wear down.

VACCINO-SYPHILITIC INOCULATION.—A most important social question, is, whether a true chancre—an infecting syphilitic sore—can be communicated by vaccination,—through the vaccine virus? Dr. Viennois, in 1860, brought forward cases, apparently, of such syphilitic transmission; other cases subsequently occurred under M. Trousseau, in the Hotel Dieu; and, since, at Rivalta, an overwhelming demonstration occurred, one child, thus infected, having re-transmitted the disease to another child, and thence, through both, to forty-five other children, and to twenty other mothers or nurses!

DIAGNOSIS OF CONSTITUTIONAL SYPHILIS.—The presence of constitutional syphilis, as manifested by secondary symptoms, is determined solely by the calculation of *probabilities*; and this is the basis of diagnosis in respect to *all* diseases, excepting the few that are absolutely determined by pathognomonic signs. The diagnostic value of any one symptom is represented by the constancy of its presence and association with the same disease, and by the early period of its occurrence.

But the *co-existence*, or at least the *consecutiveness*, of symptoms, any one of which is equivocal, *per se*; constitutes a weight of evidence greater in the *aggregate*, than that which the *several items* of evidence would represent by being merely added together.

To illustrate this force of concurrence, by the evidence of secondary symptoms, I shall pass over the order of priority of these symptoms; thus overlooking the relative value of each, as an early symptom. No one secondary symptom is sufficiently constant or peculiar to syphilis, to make their *order* of succession a question of much practical interest. But the fact of these symptoms being concurrent in the same person, outweighs their inconstancy. Let the weight of *anti* syphilitic probability be represented by 5; then any one of the five usual secondary symptoms may be absent, or, if present, may point perhaps to constitutional syphilis, perhaps to the mercurial crisis, perhaps to both; perhaps

to neither of these blood-diseases, but proceed from other causes. Thus, the skin-eruption having a coppery hue; the excavated ulcer of either or both tonsils; iritis; enlarged testicle; node, caries, necrosis; are *severally equivocal* symptoms of constitutional syphilis; but taken *collectively*, or at least as *consecutive* symptoms, they *outweigh* the supposed anti-syphilitic counterpoise. Constitutional syphilis is diagnosed by an overbalance of probabilities in its favour—this overbalance being due, not to the actual diagnostic value of each symptom or probability, but to their concurrence. In like manner, other circumstances may tend to corroborate our diagnosis. The fact of primary syphilis, present or antecedent, has its weight—the weight of an additional probability, concurring. We look for the remains of a presumed chancre or chancres, and probably, also, the vestiges of a bubo or buboes.

The diagnosis of constitutional syphilis—thus clearly illustrating the diagnostic value of concurrent symptoms—is the species of evidence on which rests the diagnosis of most other blood-diseases; and, indeed, of diseases generally, the evidence of which is *symptomatic*.

The Blood-origin of symptoms, is established, in like manner, by concurrent evidence; but all the characters of blood-disease [P. p. 276] are rarely combined, or at least not in the same degree.

*Blood-origin of Secondary Syphilis.*—The evidence is, partly, the “number of textures” affected with some form of mal-nutrition—as of the skin, mucous membrane, iris, periosteum, bone and testicle; partly, the “migratory” character of these local affections—from skin to mucous membrane, to the iris, thence to the testicle, or to periosteum and bone; and partly, the “symmetrical” character of some such local affections; occasionally also, their “serpiginous,” or creeping nature, as phagedænic ulcerations of syphilitic origin. But the last two characters would seem to indicate some determining power in the *textures*, respecting the particular locality and form in which a particular blood-disease shall manifest itself. Lastly, syphilis is capable of being propagated by “inoculation.”

*Blood-pathology of Syphilis.*—Constitutional Syphilis shares the obscurity of other blood-diseases with few exceptions. The microscope exhibits nothing remarkable; chemical analysis, at present, brings nothing to light. The potent virus works unseen, being known only by the commotion it occasions. As when a diver has disappeared beneath the surface, we watch the troubled waters, without seeing *his* operations in the deep; likewise the syphilitic virus having dived into the blood, we know nothing of its doings there until it throws up some eruption on the skin or mucous membrane. Moreover, as the debris and bubbles thrown up by a diver cannot be distinguished from the commotion produced by some monster sporting in the deep; so also the scales and pustules of syphilis are subsequent and equivocal signs of the kind of poison at work. Meanwhile, its operation proceeds silently yet surely. The virus has not hitherto been detected in the blood; nor does inoculation with syphilitic blood manifest any characteristic results. Ricord failed to discover inoculable pus in the blood, even in veins nearest the chancre. MM. Ricord and Grassi first noticed “a decrease of the globular element in the blood of persons affected with syphilis arising from the simple or non-infecting chancre;” and indurated chancre also is apparently followed by a diminished proportion of globules, while the albumen increases. Yet these changes are not remarkable; and to discover *the* blood-condition

which precedes the local manifestations of constitutional syphilis, is still "a consummation devoutly to be wished." Rational Preventive treatment would then, and only then, be possible and practicable.

*Causative relation of Local to Constitutional Syphilis; and the Unity or Duality of the Syphilitic Virus.*—Of the various forms of Local Syphilis already described as Chancres, opinions differ respecting their causative relation to Constitutional Syphilis. It would be impossible within the limits of this part of the work, to discuss the evidence and arguments pertaining to this vexed question.

Ricord and his school, maintain that only one form of local syphilis—the *indurated* chancre—is the source of systemic infection; that it is the infecting sore, and that it invariably produces constitutional syphilis. But that non-indurated or soft chancre, is always a local disease, and is never followed by secondary affections. Hence, indurated chancre is the *only form of primary syphilis*.

On the other hand, other observers, scarcely less distinguished, maintain; that while the indurated chancre possesses the greater power of producing constitutional syphilis, and is thence the most frequent cause; yet that *soft* chancres may also occasionally have this causative relation. Hence, they also may be regarded as forms of primary syphilis.

My own experience inclines to this latter view of the relative infecting character of hard and soft chancres.

*Inoculation* throws some light on this question. The general results of inoculation in regard to syphilis, may perhaps be stated as follows:—

1. That a chancre always produces a specific virus.
2. That all chancres—hard and soft—are capable of being propagated by inoculation.
3. That inoculation with the serum or lymph from an indurated sore will only produce a chancre, and that an indurated one, when the system is unaffected. During, therefore, only the earliest stage of such chancre—*i.e.*, prior to induration, which may be regarded as the first secondary symptom.
4. That inoculation from an indurated sore—the system being unaffected—is invariably followed by secondary affections.
5. That inoculation from a soft chancre is less certainly productive of secondary affections.
6. Secondary syphilis may be propagated by inoculation.
7. But, that inoculation from secondary syphilis, is inoperative on the individual himself, or upon another individual having secondary syphilis.
8. That the secretion of other specific diseases existing in syphilitic subjects (including the specific syphilitic pustule, and the sores which result from it), have no power of imparting constitutional syphilis. (H. Lee.)
9. That the natural secretions of glands in syphilitic subjects, when those glands are not themselves specifically diseased, have no power of imparting constitutional syphilis. (H. Lee.)\*

If any of these propositions be erroneous, the error arises not simply from the difficulty inherent in the investigation of inoculation, but also from the difficulty of rightly estimating the mass of, apparently, contradictory evidence on this subject.

The *modus operandi* of chancre in producing systemic infection, is doubtful.

\* Holmes's Surgery, 2nd Ed., 1870.



The *lymphatic* or absorbent vessels were formerly regarded by Hunter, and his school, as the only medium of transmitting the syphilitic virus. Independently of the experimental facts adduced by Ségalas and Magendie, in evidence of the *veins* also being absorbents; there are two general facts which, apparently, disprove the absorbent function of the lymphatics, in the production of syphilitic systemic infection. (1) That in those cases in which the irritation of the lymphatics is greatest, and where, therefore, we have the best evidence that the morbid matter has entered them, there is very seldom any secondary syphilitic affection. (2) That the best marked cases of systemic infection are as rarely preceded by any very evident signs of inflammation of the lymphatic glands. In the first class of cases, moreover, the progress of the syphilitic virus may be traced along the lymphatic vessels as far as the first lymphatic gland in their course, but never beyond. In any part of this course, the poison may be arrested and produce a hard knotted cord or round induration, or even a fresh chancre; but there is no proof that the virus is conveyed unchanged through these glands; on the contrary, the vessels beyond are never affected, and bubo never forms in the glands next in order. Thus, chancre on the penis or vulva, induces bubo of the gland in the groin, above Poupart's ligament, but does not affect the vessels and glands within the abdomen; chancre on the finger affects the gland on the inner side of the biceps muscle just above the elbow, but not the axillary glands.

Duly weighing these facts, and the analogy of the syphilitic virus with other poisons, in producing systemic infection; Mr. Lee is inclined to believe that the syphilitic virus is communicated *directly* to the blood, through the nutritive changes of the part around a chancre, or point of inoculation.

**TREATMENT.**—*Local Syphilis.* (1) *Chancre.*—The earliest consideration, in the treatment of chancre, is the *prevention* of systemic infection; and the more so, since, in common with all blood-diseases, Syphilis is far more preventable than curable. Hence—observes Ricord—"the grand secret is, to reduce the specific ulceration to the state of a common ulcer, and to transform a wound possessing a special virus for its maintenance, into one which no longer has such a resource."

The earliest and most exact diagnosis of chancre, cannot, as we have seen, be determined by induration; but inoculation supplies the requisite test of specificity. Moreover, in relation to the most effectual known preventive measures, induration—occurring about the end of the first week, and never before the third day—supervenes too late for their effective application.

*Escharotics*, in Ricord's experience, are available within the first *four days* only, to prevent systemic infection,—you then kill the syphilis in its germ. Sigmund, of Vienna, also states as the result of his observation, in upwards of 1000 cases, extending over eleven years, that secondary manifestations never appear when the chancre is completely destroyed within the first four days. Cauterization to be thus effective, must be, not a slight superficial cauterization, which only destroys the surface of the ulcer, but a cauterization deep, broad, and destructive. We are dealing not merely with a poisoned wound, but with a self-producing poisoned wound. A paste consisting of sulphuric acid and charcoal, or stick nitrate of silver, will answer this purpose; but it must be applied over the whole sore and around, so as to include the infected peripheric zone of tissue beyond it.



By such local treatment alone can the chancre be converted into a simple healing ulcer,—in time to prevent *systemic* infection ; and it is also the surest prophylactic *socially*,—by extinguishing the *nuclei* of contagion. But, for either preventive purpose, destruction must be accomplished within the first four days after the birth of chancre. *Excision* of an *indurated* chancre has, occasionally, been practised ; but this method of removing the cause in operation, is like that by escharotics—too late when induration has taken place ; and excision offers no advantage over cauterization.

As a public preventive measure against the propagation of primary syphilitic infection, the “Contagious Diseases Act” for the periodic inspection of different classes of the community, was recently instituted ;—a similar legislative enactment to that which is in operation in France. As might be anticipated with reference to a procedure of such nature ; its expediency has been strenuously advocated from a sanitary point of view, and an extension of the Act urged, by numerous scientific supporters ; and it has been equally denounced, on moral and social grounds, by irreconcilable opponents. The Government has wisely declared its intention of abiding the result of the most complete inquiry.

The *curative* local treatment of chancre,—as a specific sore, is best accomplished by mercury. It may be applied in the form of mercurial ointment, spread on lint, and laid on the sore ; or as a lotion,—the *lotio nigra*, consisting of calomel and lime water, in the proportions of ℥j to ʒvj ; or, by calomel fumigation, locally applied, as suggested by Mr. Lee.

No other kind of *special* or specific treatment, is necessary with regard to chancre, than its early destruction, for the purpose of preventing *systemic* infection ; or curative measures, subsequently.

The various forms which chancre may assume, as the inflamed or phagedænic sores, are to be treated by the same measures which would be appropriate for similar ulcers otherwise arising

(2) *Bubo*.—No kind of *special* treatment is here indicated. If the bubo be an indolent, hard, swelling of one or more lymphatic glands, such as generally follows a systemic infecting sore ; no kind of preventive treatment will then be of any avail,—systemic infection having already taken place, and the bubo itself occasions little inconvenience ; if the bubo has suppurated and become an abscess, it is to be treated according to the course and tendency of other abscesses, not of syphilitic origin, and any consequent ulcer, in like manner.

*Constitutional Syphilis*.—*Preventive treatment* still claims our first consideration. After the limited period for the prevention of systemic infection, by the destruction of chancre, and before constitutional syphilis is manifested by any secondary symptom, there is yet an intervening period of blood-inoculation,—extending over about a month or six weeks, more or less, during which the development of constitutional syphilis may be intercepted. Otherwise, the blood will assuredly declare its noxious influence on nutrition, in due time ; by some secondary disease of the skin, by sore throat, iritis, and so forth. The impending evil is sure to supervene, in some form, the storm is sure to burst. There follows the *indurated* or infecting chancre,—says Ricord—a blood diathesis pregnant with misfortunes and tempests. An infallible explosion of constitutional affections will ensue.

But if some such manifestations are inevitable, in the natural course of systemic infection, all experience concurs, I believe, in the possibility

of averting them by medicinal intervention. By what particular preventive measures? Here opinions differ widely.

*Mercury* has long been, and is still generally, credited with the most potent prophylactic influence. The symptoms of its protective operation, constituting mercurialization, and the modes of administering mercury, will be noticed presently, in connexion with the curative efficacy of this medicinal agent. It appears indisputable; that if mercury be not preventive of systemic infection, no other known medicinal agent possesses such influence in any perceptible degree. The chief difficulty attending investigations, with reference to this question, is first to determine the natural course of local syphilis, in its *different* forms,—whether or not systemic infection would assuredly supervene; and thus, with corresponding certainty, to estimate the positive and negative results of mercurialization, or of other supposed protective measures.

*Remedial Treatment.*—*Mercury* holds the first place, and *iodide of potassium* the second, in the present anti-syphilitic materia medica. It would be impossible and useless to enumerate all the various remedies for constitutional syphilis, which have been tried and failed, more or less entirely. Such are sarsaparilla, guaiacum, opium, conium, juniper, sassafras, dulcamara, &c.

Mercury seems to produce a systemic condition which is antagonistic to, and incompatible with, constitutional syphilis, in most of the forms of its manifestation. And, indeed, this positively remedial operation of mercury, is rendered equivocal, only by the fact, that the natural tendency of syphilis to recovery requires further clinical observation.

The *symptoms* of the systemic influence of mercury, and of its sufficient operation remedially; are, a slight tenderness of the gums adjoining the teeth, with, perhaps, a slightly increased flow of saliva, factor of the breath, and a coppery taste in the mouth. But this degree of salivation must be maintained, until any secondary symptoms, whether as regards the skin, the throat, or the eyes, has entirely subsided; including also induration of the primary sore. Not until then can mercury be safely discontinued, with a view to the non-recurrence of secondary symptoms.

The *administration* of mercury is a matter of equal importance, and scarcely less so, the *kind* of mercurial preparations employed. It may be introduced into the system, through the gastro-intestinal mucous membrane, by pills or solution taken internally; or through the skin, by the rubbing in of ointment, inunction; or by exposure to vapour, fumigation,—mercurial bath; or, by inhalation.

Blue-pill—*pilula hydrargyri*, from three to five grains, two or three times a day; or calomel, a grain or more, in the form of a pill, and taken as often; have long been favourite forms of administering mercury. But these preparations are apt to produce irritation of the gastro-intestinal canal, and the liver, by their continued use,—occasioning bilious diarrhoea and sickness, long before their beneficial operation on the system can take place. Their introduction is, in fact, thus intercepted, and the mercury is said to “run off by the bowels.” A small proportion of opium—say, a quarter of a grain, combined with each pill, will tend to make the blue-pill or calomel settle on the stomach. The *iodide* of mercury, combined with opium in the form of a pill, is the preparation which I have long been in the habit of prescribing. It is less irritating to the stomach, and equally remedial. The *liquor hydrargyri bichloridi*, in half drachm doses, more or less, is a convenient form of administering mer-

cury internally; but I use it rather to sustain the systemic influence of the iodide.

Mercurial *inunction* supplies a more sure method of affecting the system, without any collateral disturbance of the digestive organs. It consists in rubbing in a small quantity of some mercurial ointment on the inner or thin-skinned aspect of the thighs, every night. A drachm of the blue ointment unguentum hydrargyri, may be thus continued nightly, until the gums are touched, and the secondary symptoms evidently subsiding. The ointment must be rubbed in until it disappears, and then the greasy surface should be left unwashed. This, however, is a laborious and dirty ordeal, an additional penalty for any one to pay besides having syphilis.

Mercurial *fumigation* may be preferable as a more cleanly and equally efficacious mode of introducing mercury through the skin. It consists in exposing the surface of the body, enveloped in a blanket up to the chin, to the fumes of some mercurial powder, which is heated until it rises in the form of vapour, and which can be advantageously associated with steam, as a vapour bath. For this purpose, an apparatus has been contrived by Messrs. Savigny. Or, a more ready contrivance, is a half brick, heated to a dull redness, on which the powder is placed, and set in a pan containing a little water. Calomel is the mercurial preparation generally employed; and fifteen or twenty grains, the quantity usually sufficient, will undergo volatilization, entirely, in fifteen or twenty minutes. The patient is then put to bed, so that the particles of calomel shall not be wiped off the surface of the body. This mode of introducing mercury is highly recommended by Mr. Lee, who observes that in his experience, neither of the other modes removes the symptoms so readily as calomel fumigation; none is attended by so little mischief to the patient's constitution; and none is followed so seldom by a relapse. He extends it, as I have already mentioned, to the local treatment of primary sores; and by means of a tube and mouth-piece, the vapour of calomel can be conveyed to the throat, for the treatment of secondary syphilitic ulceration affecting that part.

Mercurial *inhalation* can be administered by a simple and efficient form of inhaler, which is easily constructed; a common earthen tea-pot, to the spout of which is attached a tube of vulcanized india-rubber, about a foot long, and provided with a bone mouth-piece, in shape like the amber of a meerschauu pipe. A scruple of calomel is placed in the tea-pot, and the little hole in the lid which allows the escape of steam, is stopped with a peg of tightly rolled paper,—better than wood which yields and loosens in driving it in. The pot thus equipped is ready for use. Resting on an iron tripod stand, the bottom of the pot is exposed to the flame of a spirit-lamp, placed sufficiently near, so that the flame shall expand under the whole bottom. In two or three minutes, the calomel begins to pass into vapour, and, the lid having been raised for a moment to ascertain that fact, the patient is told to inspire through the mouth-piece, at the same moment closing his nostrils between his thumb and fore-finger, then expire through the nostrils; and so on alternately, breathing in a naturally free and easy manner. After about ten or fifteen minutes, all the calomel will have been inhaled as vapour, save a small quantity which adheres as a thin, white film to the interior of the pot and tube.

In two cases wherein I have resorted to the inhalation of calomel-vapour for the treatment of secondary syphilis, with ulceration and



sloughing of the throat, the tea-pot inhaler, I improvised, having been used, the following facts are worthy of notice for guidance in general.

1. In both cases, previous treatment by mercury, and iodide of potassium, administered by the mouth, had been tried, successively, and failed; and, in one case, it was impossible thus to continue the treatment, these medicinal agents being absolutely rejected by the stomach with nausea, and constantly recurring sickness.

2. The gradual process of inhalation,—ten or fifteen minutes, and the quantity used, twenty grains.

3. Explosive coughing after inhalation,—variable in period of sequence, in its degree, and duration, but subsiding spontaneously and permanently. This might be moderated by reducing the quantity of calomel to, say half—ten grains, while the same beneficial influence might be gained by repeating the inhalation.

4. Slight salivation, in about forty-eight hours, and disappearance of the secondary symptoms; ulceration of the throat, especially.

5. Compared with mercurial inunction, and with the mercurial bath; the inhalation of calomel vapour, is more speedy and effectual, in its systemic influence, than the one, and far more so than the other.

6. As to safety; in one of the two cases, the patient died, some days after inhalation, from bronchitis and pneumonia, but the patient had a very feeble venous circulation, and his constitution had been worn out by an Indian climate, and great intemperance, more than by constitutional syphilis. In the other case, the pulmonic effect of inhalation was inconsiderable, and the process was repeated on four different occasions, without any danger.

The *balance* of evidence, from these two cases, is therefore, in favour of inhalation; and, relatively also to mercurial inunction, and the mercurial bath.

*Excessive mercurialization* produces symptoms which it may be convenient here to notice. They are; profuse salivation, swelling of the salivary glands, gums, tongue, and face, ulceration of the mucous membrane, loosening of the teeth and even necrosis of the jaws. Diarrhœa, with bilious evacuations. Certain varieties of skin diseases;—*e.g.*, mercurial eczema. Periostitis and ostitis, otherwise than connected with the mouth. Low fever with great prostration or mercurial erythism. Nervous affections;—*e.g.*, neuralgic pains, partial paralysis, or mercurial tremor, sometimes complete paralysis and death; usually observed in those subject to the action of mercurial fumigation.

*Iodide of potassium*.—Not to be trusted for the prevention of constitutional syphilis, ranks next to mercury as a curative agent; and especially in some forms of the disease, and in a certain constitutional condition, whether natural to the individual or morbid, where the action of mercury cannot be borne. It may be stated generally, that in the forms of skin-eruption accompanied with plastic induration, in the earlier period of constitutional syphilis, and in young and vigorous subjects, mercury is most curative; whereas, in pustular eruptions, enlargement of the testicle, periostitis and ostitis, and any tertiary affections, in the later periods of syphilis, and in debilitated, cachectic, subjects, iodide of potassium is the more remedial. But, perhaps, it may be added, that its effects are less permanent than those of mercury, and thus the disease is liable to recur. Iodide of potassium is given in doses, usually from three to five grains, thrice daily, and combined with cinchona bark, cascarilla, or other



vegetable tonic; this adjunct generally being requisite under the circumstances of suppuration or ulceration, wherein the iodide is prescribed. This medicinal agent was, I believe, originally brought into use for the treatment of constitutional syphilis, by Mr. Samuel Cooper, Mr. Morton, and other Surgeons at University College Hospital, about the time when I was a Student in that Institution; and it has since found much favour with the Profession. I have prescribed it with marked advantage in some thousands of cases, principally at the Royal Free Hospital.

Iodide of *mercury* has considerable repute with many continental surgeons; a grain being given in a pill three times a day, and gradually increased to three grains. Or, this combination may, probably, be effected in the system, by the concurrent administration of iodide of potassium or iodide of sodium, while mercury is introduced through the skin; thus obviating any irritation of the digestive organs which might be excited by giving the iodide of mercury itself.

*Sarsaparilla* has far less influence on constitutional syphilis than was formerly supposed, within my recollection. Its therapeutic value would seem to be restricted to the more asthenic or later secondary, and tertiary symptoms, and as occurring in debilitated subjects; the same circumstances which render iodide of potassium preferable to mercury. Or, again, mercury having produced a new series of symptoms simulating the syphilitic, sarsaparilla will then be remedial; or it may come into use at a subsequent period, to remove the *sequelæ* of a mercurial course. Sarsaparilla is thus, on the one hand, a substitute for iodide of potassium; or, on the other hand, an anti-mercurial. The decoction is the preparation usually employed, but it must be concentrated, and drank freely; in not less quantity than a wineglassful three times a day. It may be advantageously combined with iodide of potassium; the two forming what has been indefinitely named, an "alterative" mixture. Sarsaparilla has also a tonic influence, but less so than bark, and it is said to be diuretic and diaphoretic. This compound influence may give sarsaparilla an advantage over the more purely tonic operation of bark, when given in combination with iodide of potassium.

*Guaiacum*—another overrated medicine in relation to constitutional syphilis—is nevertheless, apparently, beneficial under similar circumstances to those which render sarsaparilla—and iodide of potassium—preferable to mercury; particularly in secondary affections of the periosteum or bone, and as occurring in cachectic subjects; or it may be useful in clearing off the effects of mercury. The stimulant and diaphoretic actions of guaiacum may, perhaps, explain its therapeutic influence in the course of secondary syphilis, and as an anti-mercurial.

It would be of little practical importance to enlarge this general view of the medicinal treatment pertaining to Syphilis. Excluding the many nostrums which, from time to time, have had a temporary remedial reputation; the details of the course of treatment, with reference to the various forms of skin eruption, and other secondary, and tertiary, syphilitic manifestations; can alone be taught at the bedside, or learnt by experience.

The pathology and treatment of Syphilis are thus summed up by Mr. Lee.

There are four varieties of local syphilis, resulting from the inoculation of the syphilitic virus, which are quite distinct, although they may occasionally succeed each other.

The *first* variety is accompanied by the adhesive inflammation, and produces a peculiar chronic enlargement of the inguinal glands, which does not involve the skin or the cellular membrane. This variety is followed by secondary symptoms, and requires, both in its primary and secondary forms, mercurial treatment.

The *second* is accompanied by suppurative inflammation. It does not affect the inguinal glands. It is not followed by constitutional diseases, and requires merely local treatment.

The *third* is accompanied by the ulcerative inflammation. It produces suppuration, generally of one inguinal gland only, which yields an inoculable secretion. It is not followed by constitutional syphilis, and may be treated by local means.

The *fourth* is accompanied by mortification. It does not affect the inguinal glands, is not followed by constitutional symptoms, and requires only local treatment.

*Syphilization* yet remains to be noticed. It is said to be the *curative* treatment of constitutional syphilis by repeated inoculation with the syphilitic virus, and for the *prevention* of its recurrence. Syphilization is also practised for the cure of primary ulcers, under the influence of which it is said they soon lose their hardness and begin to cicatrize. Buboes are thus affected beneficially. Vegetations remain uninfluenced.

This method of treatment, originated by M. Auzias-Turenne, about 1845, and adopted by M. Sperino, is specially advocated by Professor Böeck, of Christiania, with reference to constitutional syphilis; and, in 1865, he visited this country to inculcate his views by practical illustration in the Lock Hospital. The matter from a primary syphilitic ulcer, hard or soft, the former being preferable, or that from the artificial sore of a patient undergoing syphilization, is inoculated or introduced, in the same way as vaccine matter. To prevent large ulcers and cicatrices, the inoculations are commenced on the sides of the trunk. Three inoculations are made on each side. After three days, pustules will have formed, and from these, other inoculations are then made. This is repeated every third day, the matter being always taken from the last pustules, until no further effect can be produced with this matter. Fresh matter is now introduced, from another patient; pustules ensue as from the matter first used, but the pustules and ulcers resulting from this second matter are not nearly so large as those originally produced. A third matter elicits pustules and ulcers yet smaller and fewer in number; until, ultimately, no matter applied to the sides will produce any specific effect. But, the arms and thighs are still susceptible to inoculation, either from fresh matter or from matter of the last pustule. The process is therefore now repeated on these parts in succession, until there also an immunity is obtained. Ordinarily, this occurs in from three to four months.

The conclusions arrived at by Professor Böeck are:—

- (1) That artificial chancres on the sides and on the arms are always smaller than those on the thighs, and the series of inoculations shorter.
- (2) By continued inoculation the ulcers always become less and less, until at last inoculation gives a perfectly negative result.
- (3) The inoculated individual grows insensible to one matter, but is still susceptible to another, yet in a lower degree; and again to a third matter, but in a still lower degree; and so on until no further effect is produced by any matter.
- (4) Immunity having been obtained on the sides and on the arms, it

will still be possible to have rather a long series of inoculations on the thighs.

All these phenomena are said to be constant; they do not occur in one individual and not in another; they will always be presented. "We have here an invariable law of nature."

A *saturation* of the system with syphilis—according to MM. Auzias-Turenne and Sperino—is thus established; a syphilitic *diathesis*—according to Dr. Böeck—which, when once established, cannot be increased or intensified by the further inoculation of virulent matter. But the continued insertion of this matter, stimulates the disease and enables it to pass through its regular course; thus completing the series of phenomena which follow systemic syphilitic infection, in a *far shorter period* than if left to itself, or subjected to any other method of treatment. Relapses and the occurrence of the so-called tertiary disease, are therefore rarely found after this curative treatment; whilst the continued introduction of syphilitic matter into the system, destroys, in a varying period of time, the susceptibility of the individual; ultimately producing a local as well as a general immunity to the disease, which constitutes its preventive treatment.

Patients of all ages, even very young infants who are the subjects of *hereditary* disease, have undergone this course of treatment. In the latter, however, inoculations will frequently not take effect; nor in persons with acquired constitutional syphilis, who, at the same time, are suffering from some acute or debilitating disease. But the latter adverse conditions are temporary, and immunity is generally obtained. Its duration in regard to the local action of the virus is limited, freedom from susceptibility to the production of chancre being gradually lost after the inoculations have been discontinued; but the systemic immunity continues, and frequently throughout the life of the patient.

These results have been attested, it is said, by some hundreds of cases.

It is admitted, however, that the success of syphilization is very much modified by the fact of whether, or not, the patient had previously undergone mercurial treatment. Dr. Böeck alleges that mercury interrupts and retards the natural course of syphilis, and that, in like manner, it interferes with its treatment by continued inoculation,—thus diminishing the curative efficacy of syphilization.

It was at this stage of the inquiry more particularly, that syphilization was tested at the Lock Hospital, in 27 cases, under Dr. Böeck's immediate supervision. Mr. James R. Lane, and Mr. Gascoyen—the surgeons to that Institution—have supplied an elaborate Report\* of these cases; which, while it contributed interesting particulars on points connected with the clinical history of syphilization, and indirectly with the pathology of Syphilis, condemns it as a method of treatment. On this aspect of the question, the report concludes:—"We are entirely in accord as to the practical bearings of Syphilization, and we are decidedly of opinion that it is not a treatment which can be recommended for adoption. We consider that, even if it could be admitted to possess all the advantages claimed for it by its advocates, its superiority over other modes of treatment, or in many instances over no treatment at all, would not sufficiently compensate for its tediousness, its painfulness, and the life-long marking which it entails upon the patient.

\* Med.-Chir. Trans., 1867.



"If Syphilization could be relied upon, after other treatment had failed, to control the severer forms of the disease, especially in its tertiary stage, or to prevent its hereditary transmission, the benefit derived would, without doubt, more than counterbalance these disadvantages; but unfortunately these are precisely the cases in which it has admittedly the least influence."

## CHAPTER VIII.

### ERYSIPELAS.

ERYSIPELAS is a blood-disease, manifested by a peculiar inflammation of the skin, and subcellular texture, possibly also of the mucous membrane; and of an infectious character. The latter element of this definition is disputed, and indeed open to doubt.

Any such doubt, and disputation, seem to have arisen from one oversight—that of associating erysipelas, as a peculiar inflammation of the skin and subcellular texture of the *head and face only*, with *erysipelatous inflammation* of the skin and subcellular texture of any other part of the body. The former is decidedly infectious; the latter, apart from co-operating causes, less decidedly so.

*Simple Erysipelas.*—Commencing in the integuments of the head and face, simple erysipelas exhibits the following characteristic appearances:—On the nose, either cheek, the margin of either ear, or sometimes on one of the temples, a slight blush of redness becomes visible, accompanied with stiffness rather than swelling of the *skin*; which has lost only its wonted suppleness, and acquired a shiny roseate hue. A tingling, burning sensation also, rather than pain, is experienced, and hence the popular name of this inflammation—St. Anthony's Fire. The redness of erysipelas assumes different tints; usually being more scarlet, rather than purple; but of whatever tint it may be, it disappears entirely on pressure, and returns immediately the finger is withdrawn—so free and persistent is the determination of blood. The tension also of the skin is readily perceived on passing the finger from the sound to the inflamed part. An abrupt margin defines this redness and this stiffness; both are circumscribed by an irregular line.

The inflammation, thus mapped out, spreads continuously: erysipelas is, par excellence, a "serpiginous" skin affection; and while it diverges, creeping like water spilt on an impervious surface, the skin becomes swollen, some serum is effused into the subcellular texture also, and *this* swelling is soft and diffused. Nature makes no adequate reparative effort to limit and circumscribe the serum with lymph. Serous effusion, therefore, proceeds, and the swelling increases—so much so as to close the eyelids, distend the cheeks, disfigure the features, and, at length, obliterate all traces of personal identification. "What great events from little causes spring:" that trifling red nose, and now this defaced visage. The turgid textures are tense and painful, although still a burning pain.

*Terminations.*—At this stage of the inflammation its course is sometimes arrested, the redness fades, the swelling subsides; and this termination by *resolution* occurs with or without shedding of the cuticle. In many instances, however, the issue is less speedy. Serous effusion, having



continued for a period varying from twelve to thirty-six hours, elevates the cuticle into vesicles, or larger blebs, exactly like those which follow a burn or scald. These semi-transparent and yellowish, or sometimes livid blisters, soon burst, and discharging their contents—serum, pure or bloody—subside into thin incrustations. When, in the course of a few days, these peel off, they disclose the subjacent skin either in a sound state or beset with superficial ulcerations. In some instances the true skin is less spared. It has a reddish-brown or livid hue, and even *gangrene* of the skin succeeds; announced by great tension, heat, and acute pain. But this issue of erysipelas is rare, and generally fatal.

Such are the origin, course, and terminations of *simple* erysipelas—an inflammation akin to erythema, and contrasting with the *phlegmonous* variety, in which the *skin* and *subcellular* texture are both the seat of inflammation; the latter tissue being more especially, but secondarily, engaged.

*Phlegmonous Erysipelas—and its Diagnostic characters.*—The roseate hue, if it should appear in the first instance, is soon exchanged for a brownish or livid tint which mottles the skin. Simultaneously, the subcellular texture is gorged with serum, and presents a considerable swelling, which, however, readily pits on pressure with the finger. This *œdematous* swelling, of considerable size, and this *purple* shade of colour exhibited by the skin, contrast with the characters of simple erysipelas as it first appears. The burning pain also is more severe, and perhaps accompanied with throbbing. Otherwise the simple and phlegmonous varieties have points of resemblance. In both, the redness presents a defined margin; in both, the inflammation extends itself continuously by creeping over the surface. But then again, in phlegmonous erysipelas, serous infiltration of the subcellular texture advances and deepens with alarming rapidity; and although itself diffused, the stuffed cushion of cellular tissue soon feels *bravny*. A few small vesicles only represent the overflow of serum under the cuticle; they do not reveal the perilous state of affairs beneath the skin.

*Terminations.*—Burrowing *suppuration* and rapid *sloughing* threaten; these dangers *not* being attended with increased tension, swelling, and pointing, as in phlegmonous inflammation; on the contrary, rather with diminished tension, subsidence, and flaccidity. Such is the experience of Lawrence,\* and of another original observer of this disease. At that period, writes Dupuytren,† when phlyctenæ have formed, and the cellular texture becomes thickened and indurated, the symptoms appear for two, three, or four days to be stationary; and an inexperienced surgeon is even led to hope for the resolution of the inflammation, while the danger is really urgent and suppuration already exists. This, then, is the critical period of phlegmonous erysipelas. If unchecked, the conclusion of its career is told in a few words. Very soon after this period of deceitful calm comes an outburst. A more livid hue overshadows the integuments; the skin melts away in patches, accompanied with a discharge of bloody sanious fluid, and the exposure of white sloughs of cellular tissue, portions of which bulge here and there through apertures in the integument. Sometimes this texture perishes extensively, but if partially spared, large sloughs of cellular tissue, resembling masses of soddened tow, are eventually detached; while the adjoining cellular texture is

\* Med.-Chir. Trans., vol. xiv.

† Clin. Chir., t. ii. p. 311.

drilled with small abscesses, or a profuse suppuration burrows wherever fluid can find its way—between muscles, and possibly into a neighbouring joint. Thus all parts around become involved in the ravages of phlegmonous erysipelas. In one fatal case, under Dupuytren's observation, the whole leg was laid bare of skin and cellular tissue, exposing the tibia and patella. After prolonged suppuration and sloughing, those textures which do escape—the muscles, fasciæ, tendons, and bones—are so agglutinated together as to seriously and permanently impair their uses in the animal economy.

It will be readily imagined that Erysipelas may spread from the scalp and face, to the neck, thence to the thorax, and occasionally extend as far as the extremities; or it may begin in some other part than the head and face—such as the leg, sometimes the trunk. In whatever part of the body Erysipelas first shows itself, its characters and course are similar; but while fading in that portion of the skin where it first appeared, it travels to the neighbouring skin. The various stages of this inflammation, therefore usually coexist in different parts of the skin; the portion last affected being red and swollen, another part vesicated, while others are undergoing desquamation.

It seems unnecessary to add a third variety of Erysipelas—the “œdematous” of some authors, for the phlegmonous variety is itself œdematous in one stage of its career. In both, a diffused infiltration of the subcutaneous cellular texture with serum is conspicuous, and the pitting of this œdema on pressure with the finger its most distinctive character.

*Phlegmonous inflammation* contrasts with phlegmonous erysipelas in certain particulars, and which determine their diagnosis—a question of much importance. Circumscribed and limited infiltration of the subcutaneous cellular texture with coagulating lymph, is the essential pathological condition peculiar to phlegmon. It is an inflammation of the *cellular texture primarily*, the skin being only secondarily involved; whereas phlegmonous erysipelas selects, first, the skin, and then involves the subcellular tissue. *Coagulating lymph*, rather than serum, is effused in phlegmon; the consequent swelling is therefore *circumscribed and limited*, instead of being diffused and wide-spreading; it is also *brawny in the first instance*, that of phlegmonous erysipelas only becomes so gradually; lastly, respecting the issue of these two species of inflammation—that of erysipelas is *prone* to slough, while that of phlegmon is liable only to this termination.

One word about a disputed matter: the liability of *mucous membranes*, as well as skin, to erysipelatous inflammation. This question is answered affirmatively by Stevenson, who gives a series of 21 cases,\* and subsequently by Arnott in an elaborate paper.† The former describes an affection of the throat, characterized by a red or purplish blush of the velum pendulum and uvula, with very little tumefaction, but considerable pain in swallowing. Excoriation of the inflamed surface frequently occurs, and superficial ulceration. This inflammation is *preceded* by febrile symptoms, even in mild cases, and may occur before or after the skin affection; it may, indeed, constitute the whole attack of erysipelas, without that of the skin supervening. Other men of observation—Lawrence, for instance, with whom I am inclined to concur—do not acknow-

\* Cases illustrating the contagious nature of erysipelas, and its connexion with a severe affection of the throat. *Edin. Med.-Chir. Trans.*, vol. ii., 1826.

† *Lond. Med. and Physical Journ.*, vol. lvii., 1827.

ledge erysipelatous inflammation of any mucous membrane. But this is still an open question.

*Fever.*—Erysipelas is not announced by any peculiar functional disturbances. They constitute a fever, and of the typhoid type. But, as Gregory observes, "there is nothing characteristic of approaching erysipelas, as contra-distinguished from any other kind of eruptive ailment." "The pulse is peculiarly quick and sharp at the onset of this fever." Erysipelas of the face is said to be *preceded* and accompanied by a fever, of which "a peculiar affection of the sensorium" is the prominent symptom; and the initiatory fever of idiopathic erysipelas, in every case, is said to be accompanied by "inflammation of the fauces." Both these statements are confirmed by Arnott, and the latter symptom—sore throat—is associated, in Sir Thomas Watson's experience, with erysipelas of the head and face.

*Blood-pathology.*—Erysipelas has been thus examined, yet with little result. The blood is rich in fibrin, and poor in globules; but these alterations, together with others that occur, are common to all the phlegmasiæ. They are not peculiar to erysipelas, and therefore not characteristic. The circumstances of therapeutic treatment, age, &c., seriously affect the results of any analysis obtained in respect of this, as well as of all blood-diseases.

*Blood-origin, and Infection.*—Erysipelas may be caused by infection—*i.e.*, it may be produced by inhalation from a person having the disease. But this mode of production is observed only in some cases. Of such, the following, from original authorities on this subject, are noteworthy. Certain cases reported by Dr. Wells\* are much to the point. An elderly man was attacked with erysipelas of the face, and died in about a week from the time when Dr. Wells first saw him—*viz.*, on the 8th of August. On the 19th of the following month an elderly woman, landlady of the house in which the old man had been a lodger, came under the care of Dr. Wells, also with erysipelas of the face. On inquiry it was found that the old man's wife had been seized with erysipelas a few days after his decease, and had died in about a week. Another old woman who had nursed the landlady was also attacked with this disease and died. Lastly, a young man, nephew of the old man, was seized, shortly after visiting his uncle, and died in a few days. In this last case the probability of infection having been the cause of erysipelas is obvious, and with some probability the same mode of propagation may be inferred respecting the whole series of cases. For the report further states, that the landlady had been several times with the old man and his wife during their sickness, and that after their death she had removed some furniture from the room they had occupied to her own apartment. Cases of like import occurred in the practice of Dr. Wells's contemporaries—Mr. Whitfield, apothecary for very many years to St. Thomas's Hospital, Pitcairn, and Baillie, who made similar observations in St. George's Hospital during the years 1795-96. Many years afterwards, to show the growing impression in favour of this doctrine, I might refer to cases of infectious erysipelas, recorded severally by Dickson,† Blackett,‡ and Stevenson.§ Then Mr. Arnott|| took up the inquiry. He collected what had been

\* Trans. of a Society for the Improvement of Med. and Chir. Knowledge, 1800, vol. ii. p. 214.

† Med.-Chir. Journ., April, 1819, p. 615.

‡ Med. and Physical Journ., April, 1826. § Edin. Med.-Chir. Trans., vol. ii., 1826.

|| London Med. and Physical Journ., 1827, vol. lvii.



done by others, and added the results of his own observations. "In one family, the mother was first affected with inflammation of the pharynx, terminating in mortification. On her death the husband was attacked with inflammation of the throat and erysipelas of the face. As he recovered, the daughter was similarly seized with inflammation of the pharynx and severe erysipelas." Five years prior to this Paper, although published subsequently, a series of observations yet more convincing, if possible, were made by Dr. Gibson.\* For example, the infant son of a gentleman was seized with erysipelas on one foot. Afterwards, the mother became affected with erysipelas of the face and scalp. Then the nurse, who suckled the child, was attacked with symptoms of pneumonia. She was removed to her father's house, four miles off. He, who some days before her arrival had received a wound of the scalp, was now seized with erysipelas of the face and scalp, and died. Soon afterwards, a sister, living in the same cottage, had fever with sore throat, from which she slowly recovered. Two children, in the same house, were cut off with what appeared to be croup.

Taking a fair estimate of all these cases, it will be obvious that those are most decisive where the persons who became affected reside at some distance from the house in which erysipelas first manifested itself. Persons living together might possibly be subject to some endemic source of disease—as bad drainage, or insufficient ventilation.

But if the fact of persons acquiring erysipelas, after associating with those who have this disease, is in favour of its propagation by infection; so also, when the source of contamination is removed, the disease should cease to spread. Of this the following is an illustration:—The wards of the Dublin Fever and Dysentery Hospital were large and extremely well ventilated. "On paying my daily visit," writes Dr. Brereton,† "I observed one of the patients, who had been admitted with fever some days previously, to be formidably attacked with erysipelas. On the following day I found the patient in the next bed seized with it. On the third day, two patients in the adjoining beds were similarly attacked. I then," continues Dr. Brereton, "became seriously of opinion that the disease was contagious, but resolved not to have those already affected removed until I had tried the result of another day. On the following morning, I found three more in like manner labouring under the disease; and what made it more remarkable, they were all similarly attacked in the head and face. I had them immediately put into another ward, where there were no patients; they all recovered, and no more erysipelas afterwards appeared." In this series seven patients were attacked successively, but here the supposed cause being removed, its effect ceased.

Respecting, then, the propagation of erysipelas by infection, we have the *double* test of causation fulfilled; the presence of erysipelas is at once followed by this disease in persons associating therewith, and, being withdrawn, the disease at once ceases to multiply.

It has been affirmed by some men of observation that this law holds good *only* of erysipelas affecting the face and scalp. Arnott and Watson are of this opinion; but, restricting, as they do, their definition of this disease to its manifestation on the head and face, the law of infectious propagation becomes absolute. Other authorities, however—and the

\* Edin. Med.-Chir. Trans., vol. iii., 1829.

† Dub. Journ. of Medical Science, vol. vi. p. 176.



majority—who do not take this localized view of erysipelas, are inclined to acknowledge its propagation by infection. My own observation has not been sufficiently directed to this matter to warrant me in offering a decisive opinion; further than this, I can throw into the scale my testimony as to the infectious character of facial erysipelas, and probably of every *idiopathic* manifestation of the disease on any part of the body.

Are *fomites* capable of transmitting this disease? Yes, certainly. Among the earlier writers, Wells observed that a certain patient caught erysipelas in consequence of being laid in the unchanged bed of one who died of it. Similar instances have occurred in the experience of most practitioners, unless due precautions were taken to prevent this risk of infection. But the wards of an hospital may themselves become contaminated, and communicate the disease on a larger scale. By Gibson's Report, already quoted, we learn that a woman, with erysipelas of the hand, having been admitted into the Montrose Infirmary, and the patients in either adjoining bed having become affected, the whole ward was then cleared out, cleansed, whitewashed and fumigated. "Yet when they were again placed in that ward the disease reappeared," and it became necessary to remove all the patients from this little infirmary, and to take every precaution ere the infection was eradicated. The contaminating power of fomites, in the shape of furniture, floors, &c., is evinced by the fact that dry rubbing instead of washing the floors of an hospital, or the decks of a ship, is the surest safeguard against this source of infection. But fomites of all kinds retain most tenaciously the poison of erysipelas; and, indeed, Gregory is of opinion that this poison is banished with more difficulty than any other known miasm.

The *period of latency or incubation*—varying in each kind of infectious disease—in erysipelas, extends from two to fourteen days; and when developed, the *infecting area* is twenty to thirty feet.

*External causes.*—Erysipelas acknowledges, apparently, a *traumatic origin*, in some instances. Hence, therefore, all kinds of wounds, injuries, surgical operations, and irritants—such as blisters, caustics, &c.—are accredited causes of this species of inflammation. Besides mechanical and chemical irritants, heat and cold may be accorded their share of importance.

*Predisposing causes.*—Any external cause may be reinforced, at least, by conditions within the body; resulting mostly from previous habits of *intemperance*, previous hardships, or both, perhaps also from mental depression—circumstances which have depraved the blood and enfeebled its circulation. But the disease is also most prevalent in spring and autumn, or at least when hot and cold wet weather alternate; and if period of the year has some predisposing influence, so also has the period of life, they being most liable who are *old* in years, or old for their years.

Apart from predisposing causes, erysipelas, probably, would not arise; with their concurrence the scratch of a pin only may be apparently the traumatic origin of this disease. Yet even in such cases its infectious character becomes developed. In one instance, noticed by Lawrence,\* erysipelas of the head and face, consequent on the insertion of a seton in the neck, was the only presumptive cause of this affection in two other persons. Travers,† indeed, goes so far as to affirm that he has repeatedly seen the "*idiopathic*" arising from the "*traumatic*," or this from the former, and either from its own source.

\* Op. cit.      † Constitutional Irritation. Further Inquiry, 1835, p. 149.

Lastly, the possibility of erysipelas arising *spontaneously*—that is to say, in an individual without any assignable external cause, and therefore without infection—is, I think, indisputable.

The *recurrence* of this disease in the same individual is possible. I can speak from my own personal experience, having had it *four* times severely, in my head and face, when from nine to thirteen years of age. I was then a pupil at the King's College School, and although many years have elapsed, I well remember the flaming pain, and that my face was like a distended bladder. I just mention these particulars to verify so early a reminiscence in evidence of an important fact, that susceptibility to *true* erysipelas—*i.e.*, affecting the head and face—is not exhausted by one attack. Unlike most eruptive fevers, the blood does not lose its capability of undergoing this infection, again and again.

*Treatment.*—*Preventive* measures must have reference to the causes of this disease. Its propagation by infection suggests the prompt isolation of any person having erysipelas—as the source of infection, free ventilation of the apartment, and the separate use of any bedding or other infected article, which might act as a *fomes* in carrying the disease to other patients. Dry-scrubbing instead of washing the floor of the bedroom or ward, has already been alluded to as a safeguard; evaporations favouring, apparently, the dissemination of the infected atmosphere. Cleanliness with regard to the dressings used for other patients, and on the part of the nurses, is an obvious injunction. With all these precautions, a nurse or the practitioner himself may yet be the medium of communicating the disease. Disinfectants, such as chlorine vapour, or chlorinated solutions, permanganate of potash, and carbolic acid lotions, have more or less influence in purifying a contaminated atmosphere, or in guarding the wounds of patients who may be exposed to its operation.

These preventive measures are less urgent with reference to erysipelas of traumatic origin.

Predisposing causes, pertaining as they do mostly to the previous health of the individual, scarcely admit of prevention. They suggest, however, the greater protection of persons thus liable to infection. Such are persons whose blood has been depraved, and circulation enfeebled, by previous habits of intemperance, and by the wear and tear of a laborious, anxious life. Albuminuria is peculiarly inviting to erysipelas. Diabetic patients also are said to be liable.

*Remedial* treatment—so-called—is a misnomer; for, like all infectious diseases, erysipelas runs a certain natural course, and the only power of art is to avert any unfavourable tendency. It is probable that a blood-poison is undergoing elimination from the system, through the great secreting surfaces—the skin, thus inducing the inflammation, and the mucous membranes. Consequently, the bowels having been evacuated by a mercurial and rhubarb or colocynth pill, a saline aperient, diuretic and diaphoretic mixture, may then be given with advantage for some days. Thus, the sulphate of magnesia, with nitrate of potash and small doses of tartarized antimony, seem to promote elimination. The acetate or carbonate of ammonia, in camphor mixture, will be more specially diaphoretic. Bicarbonate of potash, in large doses, say half a drachm, has sometimes appeared to me, to fulfil a special purpose, that of neutralizing the blood-poison, whatever it be. Erysipelas is, I think, thus allied to rheumatism or rheumatic gout, to erythema and urticaria; in all of which diseases potash has some peculiar remedial influence. And in harmony

with their therapeutic affinity, I have observed clinically, that the same individuals are not unfrequently subject to each of these diseases. A dusky yellow hue of the skin, and slight yellowness of the conjunctiva, with perhaps nausea and oppression of the stomach are often present in erysipelas. This condition, verging on jaundice, is best overcome by the repeated administration of calomel or blue pill, to restore the secretion of bile. A blister over the region of the liver, is also, I believe, recommended by Mr. Syme. These measures are apparently more efficacious than the ipecacuanha emetic usually ordered to empty the *stomach*.

The saline plan of treatment will, generally, prove sufficiently depletory—as well as excretory—without having recourse to blood-letting, to however small an amount. Debility, and the increasingly typhoid character of the fever, from the commencement of the disease, soon indicate the necessity for the substitution of a stimulant and tonic treatment. Carbonate of ammonia, in five or ten-grain doses, with disulphate of quina, in similar or even larger doses, may be given every four hours. Tincture of the sequichloride of iron, from ten to twenty minims every two hours, is highly extolled by Dr. Balfour—as a certain and unfailing remedy, whether the erysipelas be infantile or adult, idiopathic or traumatic.

The *diet* must correspond to this medicinal treatment. Wine should be given, tolerably freely, in all cases, and even from the very beginning. Brandy and egg beat up together, form a convenient and agreeable mixture, at once stimulating and nourishing. Beef-tea and the other preparations of nutritious and easily assimilated food, represent the general character of our dietetic resources.

Now, the degree to which this depletory, or stimulant and tonic, plan of treatment should be pushed, will vary with the symptoms, as they are more those of inflammatory or of typhoid fever. As the pulse becomes feeble and rapid, the tongue coated with a brown fur, and increasing debility supervenes; so must the one treatment be exchanged for the other.

It is thus that the *phlegmonous* variety of erysipelas may, in the first instance, require *more* active depletory measures—purgative, diaphoretic, and diuretic salines, with antimony, in doses to touch the pulse, and the occasional use of blue-pill or calomel, in slightly cholagogue doses; but these measures must soon be exchanged for a yet *more* free administration of quina with carbonate of ammonia, and a more supporting diet also, than in simple erysipelas.

And again, erysipelas of *traumatic* origin may need yet further support, in proportion to the severity of the injury conjoined with the erysipelas.

*Local Treatment.*—Any *repressive* application would be obnoxious; not only as tending to divert the natural course of the disease, in the elimination of the blood-poison, but as possibly repelling the inflammation to some other part, its migration or metastasis being perilous and prolonging the disease. In both these respects, the cutaneous inflammation of erysipelas is analogous to an *attack* of gout.

Warm fomentations by spongio-piline or flannel steeped in a hot decoction of poppy-heads or chamomile flowers, and continuously applied, will hasten the termination of the inflammation by resolution. These epithems are also more soothing to the patient than dredging the part with flour or magnesia; a dirty, encrusting, and irritating application



formerly in vogue, and still recommended by some authorities. Nor can much be said in favour of a strong solution of nitrate of silver, as an application to the inflamed surface; which, if it fail by its astringent action to induce resolution, may, by over-stimulation, provoke sloughing. A circumferential line drawn with the nitrate of silver, strongly pencilled, was recommended by the late Dr. A. T. Thomson, for the purpose of setting up a sort of incompatible inflammation, and thus arresting the progress of the erysipelas. But this boundary rarely, if ever, proves a barrier; such at least is the result of general experience; and I now never have recourse to the nitrate of silver in either of these ways.

*Phlegmonous* erysipelas presents nothing peculiar, otherwise than as pertaining to the subcutaneous cellular texture, which, with the skin, is invariably although secondarily involved. *Free incisions*, and at an *early period*, therefore, fulfil a twofold purpose. By relieving tension, they may be preservative of the skin, and perhaps of the subcellular texture; both of which are so apt to slough extensively. Moreover, pain is thus relieved, and the inflammation itself moderated by a discharge of blood with the serum effused. It is, indeed, remarkable to notice how the skin speedily loses its purple hue, and becomes almost blanched, as the engorged vessels bleed freely; the patient acknowledging a proportionate mitigation of the pain previously endured. Incisions also facilitate the discharge of pus and sloughs, which to some extent are inevitable. The preventive and curative efficacy of this treatment is now generally admitted; but the number, length, and depth of the incisions, are particulars about which differences of opinion exist. Some surgeons prefer one long incision, a practice, however, fraught with probably more danger from shock and hæmorrhage, while it is certainly less effectual for the relief of tension than incisions in different parts. A few cuts—three or four, and of as many inches in length, will be sufficient in most cases. In no case, need they be carried deeper than into the subcutaneous slough, which is easily recognised by its ash-grey colour. The treatment subsequently is similar to that of any other suppurating and sloughing wound.

## CHAPTER IX.

### PYÆMIA, OR PURULENT INFECTION.

THE term Pyæmia literally signifies Pus in the Blood (πύον pus, αἷμα blood), or purulent infection of the blood; a systemic condition arising most commonly, or which was first observed, in connexion with the local condition known as suppurative phlebitis; and which is, generally, soon followed by the formation of secondary abscesses, or at least by collections of matter—secondary to the primary disease, and which are distributed in various remote organs and parts of the body. But, in addition to this dependent series of affections, Pyæmia has more recently acquired a more comprehensive, and less definite, pathological significance; as representing, also, the systemic infection which arises from the introduction into the blood of *animal* or *septic* matter.

Two, or more, kinds of systemic infection would thus be associated; allied in their nature, probably. It, however, seems desirable, for the



sake of accuracy and clearness of description, to dissociate them; and first, to restrict the term Pyæmia to its originally definite etymological meaning—purulent infection, and as arising, for example, from an ordinary suppurating wound; and then, give it its enlarged signification, as in connexion with poisoned wounds—for example, dissection-wound.

**PYÆMIA.**—*Symptoms.*—A wound suddenly ceases to secrete and discharge pus—becoming drier or glazed; this morbid change is followed by concussive *rigors*, more or less violent, and in duration lasting for a few moments or for some minutes; then prostration; the face looks haggard, vacant, and alarmed, as if the individual were conscious of some vital injury—the nervo-muscular system responding by a prolonged shudder. This is not necessarily accompanied with a sensation of cold. Rapid sighing completes the picture of prostration. At length the heart arouses, and the pulse rises, perhaps to 150 in a minute, beating feebly and irregularly; soon a scorching heat of skin is experienced; flooding perspiration succeeds. The paroxysm is over. Similar paroxysms may recur at periods varying from twelve to thirty-six hours;\* or at about the same hour for three or four days; or at irregular intervals.† Probably, in most cases, rigors occur once for all, then *absolute* prostration, from which no perceptible reaction ensues. Whether prostration be continued, or relieved by fits of reaction, other significant symptoms supervene. The skin becomes overcast with a dirty yellow tinge, and the abdomen tympanitic. All the secretions show signs of a blood-poison being ineffectually eliminated. Rank perspiration, often profuse, ammoniacal urine, and a putrid diarrhœa, alike compete incessantly to evacuate it; but these drains only help to complete the exhaustion. The breath has been noticed by Bérard and Mr. Gamgee to have a very peculiar odour, compared by the latter to that of sweetish liver or of new hay. In one well-marked case of pyæmia this odour was absent; and it was present without pyæmia in two other cases—one of prostatic abscess, the other, extravasation of urine after lithotripsy. The diagnostic value of this symptom is therefore equivocal. Eventually the tongue and perhaps the lips are dry and brown, or black. Sometimes a leaden hue overspreads the face (Gamgee). No time is allowed for progressive emaciation, as with hectic, prostration is so overwhelming:

“the life of all his blood  
Is touched corruptibly; and the pure brain  
(Which some suppose the soul's frail dwelling-house)  
Doth, by the idle comments that it makes,  
Foretell the ending of mortality.”

Pyæmia is not always fatal. Sédillot‡ and Vidal§ have recorded cases of recovery. Nélaton|| dissents, and affirms that death is inevitable. It takes place usually about the tenth day; sometimes earlier, as the third day, or, much later—six or seven weeks.

*Secondary Abscesses.*—Post-mortem examination reveals numerous abscesses in one or more organs and textures of the body; and they are not inaptly termed *secondary*, because subsequent to an abscess, or at least to suppuration, in some other part. Secondary abscesses most

\* On Pyæmia, J. S. Gamgee, 1853.

† Inflammation of the Veins, &c., H. Lee, 1850, Case xxxvii.

‡ De l'Infection Purulente, ou Pyémie, 1849.

§ Traité de Pathologie.

|| Élémens de Pathologie Chirurgicale, p. 167.

frequently occur in the lungs and liver. Their general characters are these:—In several portions of the organ affected, black blood has accumulated; such portions are indurated, but brittle and easily break down under slight pressure with the finger;—the texture is congested and disintegrated. Some of these disintegrated portions present a yellow spot of pus in the centre of the black mass; in other parts pus has altogether supplanted the blood and disintegrated textures; and these *pus-deposits* are tolerably circumscribed; in fact, abscesses are formed, each surrounded with a dark margin of congested texture. Mr. Lee\* states that the central spot of each affected portion at first consists of lymph, which gradually extends towards the circumference. If the disease continue, these spots suppurate, the affected portions having previously softened and disintegrated in the same order in which they were primarily solidified. Secondary abscesses are usually of a small size, in the viscera varying from a pin's head to a walnut, very numerous, and of rapid formation, a few days sufficing for their development in many organs. Although most commonly found in the lungs and liver, other organs and tissues are not exempt. They occur elsewhere—approaching the following order of frequency—in the spleen, brain, kidneys, heart, skin, mucous membranes, within serous and synovial cavities, in the muscles and cellular tissue, and in the eye; in the prostate (Gamgee).

The *diagnosis* from primary abscess is twofold. It will be observed, that the chosen seat of an ordinary or primary abscess—the cellular texture—is not the usual habitation of secondary abscesses; and usually there are no local symptoms—no pain, or functional derangement, although certain parts—as the lung, pleura, peritoneum, and intestinal canal—will not tolerate secondary abscesses without some local symptoms of disaffection. It may also come to pass, that death ensues from coma, asphyxia, or from necræmia as the result of further blood-poisoning accruing from the non-elimination of various excrementitious matters.

The blood itself has undergone serious changes of chemical composition, probably; of physical properties and vital endowments, certainly. It has less plastic power, coagulates imperfectly and less readily. Hence, the more fluid blood is apt to transude, minute hæmorrhages take place in various textures, and the gastro-intestinal mucous membrane is stained with a reddish tint.

*Pathology of Pyæmia.*—Having stated the leading facts relative to pyæmia as at present known, and its local consequences; to what theory or explanation do they point? I have just alluded to certain changes which pyæmic blood is found to have undergone after death. Now, the circumstances under which pyæmia arises lead to the *inference* that during life *pus* itself, as *bonâ fide* pus, has entered the circulation, either by suppurative inflammation of the veins—occasionally of the lymphatics, rarely of the arteries; or by absorption through the veins, aided by the lymphatics, laid open and exposed by mechanical injury, as by wounds, or rapid sloughing of the suppurating part: and that the pus thus produced within vessels, or introduced from without, possibly circulates with the blood, inducing secondary deposits. Each clause of this sentence must be submitted to the test of clinical observation.

(1) *Suppurative Phlebitis.*—Without doubt, *suppurative* inflammation

\* Op. cit., p. 52.

of a vein induces pyæmia, and thence secondary abscesses. Hunter\* originally observed, that "in all cases where inflammation of veins runs high, or extends itself considerably, it is to be expected that the whole system will be affected. For the most part, the same kind of affection takes place which arises from other inflammations, with this exception, that where no adhesions of the sides of the vein are formed, or where such adhesions are incomplete, pus, passing into the circulation, may add to the general disorder, and even render it fatal."

All subsequent observers have confirmed Hunter's observation as to the fact that suppurative phlebitis is frequently followed by pyæmia; some, moreover, have adopted his theory, that pus entering the circulation is the immediate cause, and have extended this view to interpret the formation of secondary abscesses; while no one, in my opinion, has ever disproved it. In 1815 Hodgson† supported the Hunterian theory of pyæmia; and although Travers‡ alleged that suppurative phlebitis was comparatively harmless, and the adhesive fatal; yet the influence of his opinion was soon reversed, the potency of pus-forming phlebitis re-acknowledged, and Hunter's theory re-adopted. Carmichael,§ contributed his observations and his concurrence with this interpretation of pyæmia. Abernethy|| followed, rather as a disciple than as an original observer, in this department of Pathology. Then the French school instituted investigations to discover the immediate cause of pyæmia from suppurative phlebitis. Their results were, with scarcely an exception, in favour of Hunter's suggestion. Bouillaud¶ contributed his clinical researches, ascribing the constitutional consequence of phlebitis to pus in the blood. Cruveilhier\*\* likewise came to the conclusion, that pus is transmitted from the veins in which it is formed; and his observations of the stages of suppurative phlebitis tend to establish two facts. Firstly, when pus produced within a vein is excluded from the general circulation, as by a barrier of coagulated blood, or by adhesion and obliteration of the vein, no symptoms of pyæmia ensue; secondly, when the obstruction is removed, the symptoms of pyæmia immediately commence. The unavoidable inference is, that pus is carried from within the suppurating vein into the general circulation.

It would appear that pus is first formed, not between the vein and the clot, but in the very centre of the coagulum, which soon blocks up an inflamed vein. The symptoms of pyæmia do not arise then; but the proportion of coagulum diminishes, while that of the pus increases, and this may take place here and there in the course of the vein, as the inflammation is more or less advanced, thus presenting adhesive, alternating with suppurative, phlebitis. Usually, adhesive phlebitis limits and circumscribes the suppuration; and then, also, the general mass of blood

\* Trans. of a Soc. for the Improvement of Med. and Chir. Knowledge, 1793, vol. i. p. 18.

† Diseases of Arteries and Veins, 1815, pp. 511 and 518.

‡ Wounds and Ligatures of Veins. Surg. Essays, Cooper and Travers, 3rd Edit., 1818, vol. i. p. 286.

§ Obs. on Varix and Venous Inflammation. Trans. of King's and Queen's Coll. of Phys., Ireland, 1818, vol. ii. pp. 355 and 368.

|| Essay on the Occasional Ill-consequences of Venesection. Surg. Works, 1823, vol. ii. p. 150.

¶ Recherches Cliniques pour servir à l'Histoire de la Phlébite: Revue Méd., Juin 1825, p. 424.

\*\* Anatomie Pathologique, 1829-35, tome premier, liv. xi., Phlébite et Abscess Viscéraux; also Dict. de Méd. et de Chir. Pratiques, art. Phlébite.



remains uncontaminated.\* Pyæmia does not arise under these circumstances. As phlebitis advances, the distended vein becomes knotty at the various portions where pus has accumulated; eventually the vein bursts, pus is deposited in the surrounding cellular tissue, and abscesses are formed. Pending this issue, when the dyke made by the *clots* is broken, and removed by absorption, typhoid symptoms immediately commence, announced by violent rigors, soon succeeded by death. Frequently a patient, who overnight exhibited no constitutional symptoms of pyæmia, is found next morning in a dying state, and perhaps almost the moment when pus entered the circulation can be noted.

Duly considering these facts, it is scarcely necessary to bring forward the corroborative testimony of other observers. Dance† and Blandin,‡ both attributed pyæmia to the transmission of pus from suppurating veins. Mr. Arnott,§ also was led by his observations of pyæmia in seventeen cases, cases of fatal phlebitis, to conclude that the entrance of pus into the circulation is its principal cause, “a similar influence being, perhaps, also possessed by any inflammatory secretion from the vein.” Andral|| promulgated this doctrine, and Carswell¶ likewise; alleging that with all the facts before us—namely, the existence of suppurative inflammation, the presence of a greater or less quantity of pus in the veins, evidence that the pus so situated is the product of inflammation of these veins, and of this morbid product being carried into the blood by the collateral venous circulation—it appears that a satisfactory explanation may be given of the formation of those anomalous collections of pus which take place in remote parts of the body. Dupuytren, Bérard, Vidal\*\* (de Cassis), and Sédillot†† concur in the doctrine of pus-transmission; the latter observer maintaining that pus can actually be seen in the blood when examined under the microscope. Remembering the great difficulty of clearly distinguishing pus-cells from the pale corpuscles of blood, I cannot accord much weight to this argument. Certain observers have been content to record the important fact that suppurative phlebitis very frequently induces the constitutional disorder known as “pyæmia,” without specifying its immediate cause. Ribes‡‡ does not assign the transmission of pus nor any other explanation of this question; neither does Breschet§§ nor Guthrie.|||

On the other hand, respecting suppurative phlebitis as a source of pyæmia; it is alleged by some observers, that the living membrane of veins is indisposed to inflame and is perhaps incapable of secreting pus. The systemic infection is attributed by Virchow, and other pathologists, to the disintegration and decomposition of *fibrin*, in the shape of coagulum within the veins, and which enters the circulation.

\* Anat. Pathol. liv. xi. pl. 1.

† Arch. de Méd., 1828-29 : De la Phlébite Uterine, et de la Phlébite en général.

‡ Journ. Hebdom. de Méd., 1829, tome ii. : Sur quelques Accidens, &c., à la suite des Amputations.

§ Path. Inq. into the Secondary Effects of Inflammation of the Veins, 1829.

|| Pathological Anatomy. Trans. 1831, vol. ii. pp. 419 and 422.

¶ Elementary Forms of Disease, 1838, art. Pus and Purulent Deposits.

\*\* Traité de Pathologie Externe, et de Médecine Opératoire, 1846, tome deuxième, pp. 82-87. †† De l'Infection Purulente, ou Pyémie, 1849.

‡‡ Exposé sommaire de quelques Recher. Anatom., Physiol., et Path : Mém. de la Soc. Méd. d'Emulation, 1817, tome viii. p. 624.

§§ De l'Inflammation des Veines, ou de la Phlébite : Journ. Complémentaire du Dict. des Sciences Méd., 1819, tome ii. p. 325, tome iii. p. 317.

||| Treatise on Gunshot Wounds, 3rd edit., 1827, p. 299.



Others have denied the possibility of pus entering the circulation under the ordinary circumstances of suppurative phlebitis. Tessier\* alleges that at *all* stages of venous inflammation the pus is *enclosed* in the cavity of the vein by clots or false membranes, and that at no period of the anatomico-pathological existence of phlebitis, is its entrance into the blood possible. Mr. Lee appeals to the results of experiments on blood out of the body. In the preface to his Jacksonian Prize Essay,† he urges that “the simple experiment of mixing some pus with healthy, recently drawn blood, will at once show that such a combination cannot circulate in the living body. It will be found that the blood *coagulates* round the globules of pus, and forms a solid mass which will adhere to the first surface with which it comes in contact; and it will be evident that it is not till the coagulum thus formed is broken up or dissolved that its elements can circulate with the blood.” But, Mr. Lee’s inference from his “simple experiment” *assumes* that that which is true of blood mixed with pus *out* of the body, is also true of blood *circulating* with pus *in* the *living* body. The inference drawn breaks down, because the circumstances of the two cases are so essentially different. This, as Hunter said, is “putting living and dead animal matter upon the same footing, which is a contradiction in itself.” The inference which Mr. Lee has drawn from his experiments is therefore without appropriate foundation.

(2) *Suppurative Lymphatitis*.—The fair inference from all the facts—pathological and clinical—which I have adduced is, that pus *enters* the general circulation during the course of suppurative phlebitis. By analogy, pyæmia may be expected to arise also from suppurative inflammation of the *lymphatics*. Similar symptoms to those of pyæmia arise occasionally after slight pricks and wounds received in dissection, and similar consequences ensue. How far this constitutional disorder, and these consequences, are due to the *animal* or *septic* matter inoculated, is uncertain. The very worst constitutional symptoms may follow the slightest prick where the quantity of animal matter introduced must have been minute; and equally bad symptoms may follow a bleeding wound where the animal matter has been washed away: while the most fatal cases are generally those of wounds received in the post-mortem examination of uterine phlebitis with suppuration, and pus-forming peritonitis; and lastly, the constitutional symptoms are in the *ratio* of the local inflammation and suppuration.

For these reasons I am inclined to regard the constitutional disorder arising from *dissection wounds*, when *accompanied* with inflammation of the lymphatics, as pyæmia, from pus having thus entered the general circulation. And as I have said, the symptoms and the consequences are similar. Severe *rigors* announce the transmission of pus; this primary symptom occurring, not at the time of the prick or cut, but after the lymphatics have become inflamed. Prostration, extreme, with a countenance expressing dread apprehension, show that the poison continues in operation. Partial reaction may succeed, but eventually the pulse becomes very weak and very rapid. A dusky yellow tinge sometimes overshadows the skin, and the tongue is coated with a brown fur. Fætid perspiration and alvine evacuations may apparently eliminate the poison and restore health, or oppressive wandering delirium betoken approaching

\* Archives Générales de Médecine, 1839, iii. ; et nouvelle sér., t. iv. p. 86.

† On the Origin of Inflammation of the Veins, and on the Causes, Consequences, and Treatment of Purulent Deposits, 1850.

death. Such are the chief general symptoms. Local and significant ones have also been noticed, and accurately described, by Macartney,\* Colles, and others. As the disease progresses, inflammatory tumours arise successively in parts of the body remote from the original wound, and of a character which augments the constitutional sympathy, for they are not bounded by the effusion of lymph. According to Macartney, pus is rarely formed, and when these tumours have been cut into on the supposition of their being abscesses, they have been usually found to contain only a bloody serum. Mr. S. Cooper states† that, in a large proportion of the cases which he attended, purulent matter was formed and discharged. A common situation for such abscess is under the great pectoral muscle. Local signs of inflammation are frequently present. Colles‡ dwells on the significance of a peach-blossom redness, unlike the hue of erysipelas, and acute pain is sometimes felt in the part. Thus these secondary purulent collections contrast somewhat with those which proceed from suppurative phlebitis.

(3) *Arteritis* rarely advances to suppuration, and more rarely are there any constitutional symptoms of pyæmia. But now and then, utter prostration, with an incredibly rapid pulse, suggest this inference, and the oppressive delirium of pyæmia speedily closes the scene. Post-mortem examination is wanting to complete our knowledge of these cases.

(4) Suppurative phlebitis, suppurative inflammation of the lymphatics, and possibly, suppurative arteritis, are not the only sources of pyæmia; the immediate cause being the *direct* transmission of pus from the vessels in which it is formed into the general circulation. Precisely the same constitutional disorder frequently follows the *absorption* of pus from suppurating surfaces, as wounds and sores. Velpeau, Maréchal, Rochoux, and others have attributed pyæmia solely to absorption, and in such cases.

What are the particular circumstances which allow the absorption of pus from a suppurating surface, so as to induce pyæmia? It is well known that pus may be absorbed from an abscess without pyæmia ensuing; and long since Cruveilhier§ pointed out the important distinction between the absorption of pus when *prepared* for absorption, and pus in the condition of pus, at once entering the circulation. In the former case, no constitutional disturbance follows; in the latter, pyæmia. To allow of the absorption of pus in an *unaltered* condition, the *absorbing vessels* must have been laid *open*; the veins, lymphatics, or both, must have undergone solution of continuity; and this, either by a wound without subsequent repair, or by rapid sloughing, without time for closure of the vessels by the adhesive process. They therefore remain open during suppuration, and their mouths—so to speak—being in immediate contact with pus, allow of its admission, and transmission.

This mode of purulent infection accords with Mr. Liston's observation,|| that, "when from any cause the extremity of a large vein in a wound is not closed—when it is not plugged up by plastic matter, pus seems to enter it readily, and by mixing with the circulating fluid, causes dreadful mischief. Great constitutional disturbance accompanies the purulent deposits which follow in the solid viscera and in the joints." In

\* On Inflammation, 1838, p. 105.

† First Lines of the Theory and Practice of Surgery, 7th edit., 1840, p. 188.

‡ Dublin Hosp. Reports, vols. iii. and iv.

§ Anat. Path. Inflam. des Sinus de la Duré Mère, livraison vii., and Phlébite Utérine, liv. iv.

|| Elements of Surgery, 1840, p. 151.

other cases these results are preceded by rapid sloughing. A wound suddenly loses all power of healing by adhesion, and any adhesions that may have formed give way, the granulations become pale and flabby, and true pus is no longer discharged; the surface acquires a mottled brown colour, and by this time symptoms of pyæmia have commenced. Burns, attended with extensive suppuration, are not unfrequently followed by pyæmia; and certain specific diseases, as glanders, in like manner, threaten purulent affection by absorption. Occasionally, suppurative phlebitis advances so far as to allow of absorption through a vein having burst, and opened into an abscess. In one case, the femoral, popliteal, posterior tibial, and peroneal veins, communicated with abscesses (Cruveilhier). In another case, the internal jugular vein opened into a neighbouring abscess (Travers). More frequently, inflammation of the lymphatics is accompanied with extensively diffused suppuration, and induces pyæmia, partly by the absorption of pus.

*Formation of Secondary Abscesses.*—The mode of production of secondary abscesses, in various and remote organs and parts of the body, in consequence of purulent infection of the blood, is doubtful. It may be, by the arrest, and actual deposition of pus in the capillaries of the parts affected, conveyed there through the circulation—the theory originally entertained; or, that the arrest of pus, or of disintegrated fibrin, in these vessels, induces suppurative inflammation—phlebitis, of the smaller veins. This latter mode of formation was suggested by Cruveilhier, and seems to be the more probable explanation of secondary abscesses.

*EXCITING CAUSES, AND THEIR OPERATION.*—*Injuries and surgical operations* attended with much suppuration, are well known to threaten pyæmia; and they do so *partly*, perhaps, by absorption of pus, and *partly*, by suppurative inflammation of the disorganized veins. Compound fractures may thus occasion purulent infection; and injuries of the head probably operate chiefly by suppurative inflammation of the veins of the diploe. Dance first suggested this explanation; Cruveilhier gave the anatomical proof by dissection. Indeed, the latter observer affirms that phlebitis of bones is one of the most frequent causes of visceral abscesses, from wounds and surgical operations implicating the bones. The mere removal of a piece of necrosed bone is sometimes followed by pyæmia; but whenever destruction of the osseous texture, accompanied with suppuration, is followed by pyæmia, absorption of pus probably has been partly the cause, its absorption being determined by the anatomical condition of the veins, which are kept open by the bony channels through which they pass. Amputations of the limbs, of the breast, lithotomy, and the operation for fistula in ano, likewise threaten pyæmia, when suppuration is abundant. Absorption and suppurative phlebitis may co-operate in these cases to infect the blood with pus. They assuredly co-operate in pyæmia following venesection. The vein is punctured, and the aperture absorbs pus, subsequently diffused around the vein; while the vein itself, having suppurated, transmits pus into the general circulation. Probably, suppurative inflammation of the lymphatics contributes to pyæmia, in some cases where and when absorption of pus may have taken place. A faint blush in the course of the lymphatics frequently supervenes on the sudden cessation of a purulent discharge; forthwith pyæmic symptoms commence; eventually the lymphatic vessels appear as red lines ramifying from the sore, becoming harder and more painful—more inflamed, in fact, as pyæmia advances.



*Treatment.*—*Preventive* measures will consist in the rigorous observance of hygienic precautions, especially with regard to cleanliness in dressing a wound, and free ventilation; and in the preparation of the Patient for any operation (p. 11). Pyæmia is scarcely amenable to any *remedial* measures. Stimulants and tonics, with as much nutritious and readily assimilated food, as can be taken, constitute the only plan of treatment for probably sustaining the patient through the dread exhaustion which must be undergone, even when recovery ensues. Thus, wine, brandy, or as brandy and egg-mixture, strong beef tea, ammonia and quinine—in large doses, as four or five grains, may be administered repeatedly, every three or four hours. Opium has a marked beneficial influence in controlling the rapidity of the pulse, and the general irritability associated with prostration. Cleanliness in the dressing of any wound, and free ventilation, must also be observed. Secondary abscesses, when tense, and in any superficial or accessible part, may be opened; and by a valvular incision, as in the treatment of a chronic abscess, so as not to admit air to the readily decomposing purulent collection.

## CHAPTER X.

### HOSPITAL GANGRENE.

HOSPITAL GANGRENE is fortunately known to but few surgeons in civil practice now living; and we must refer to those of the past for information. The shortcomings of personal observation, are however amply compensated by the testimony of many witnesses on record; for a disease so formidable has ever been watched with deep interest whenever it occurred. From *original* sources of information, therefore, we are enabled to identify this disease, while its etiology suggests appropriate preventive measures. Hospital gangrene has received various other names; not because of any doubt respecting its pathological nature, but as expressive of its various characters, and mode of origin. Thus, Pulpal Gangrene, Phagedænic Gangrene, Sloughing Phagedæna, Putrid Ulcer, Pourriture, Contagious Gangrene, and Hospital Sore, are severally synonymous.

*Signs, and Diagnostic Characters.*—Overlooking the many phases of this gangrene, and regarding only its more constant phenomena, its nature is perhaps best expressed by denominating it, *essentially*,—*gangrenous* inflammation; that is to say, inflammation certainly, but inflammation passing at *once* into gangrene, thereby appearing only a process of textural disintegration and disorganization. Sometimes the process of destruction resembles more that of phagedæna, alternating with rapid sloughing; so that the worm-eaten phagedænic surface suddenly becomes a large slough, and then again phagedænic. These different aspects of the disease are apt to mask its really gangrenous character. What, then, are the phenomena more constantly observed? Acute pain, sudden engorgement and bloated swelling, dusky-red discoloration around the doomed part, and conversion of its textures into a putrid glutinous or slimy slough, exhaling a peculiar fœtid odour. Rapidly extending, all the soft textures are soon melted down, leaving



only the bones staring, of an ebony black,—as if the rafters of a house where a fire has raged.

These *general* characters are clearly visible in the portraits of this disease, drawn by eye-witnesses; varied, however, by special circumstances; principally, by the previous kind of injury to the part affected, the textures engaged, and the constitution of the individual.

*Origin and Course.*—To identify this gangrene under the modifying circumstances referred to, it is necessary to trace its origin and progress—in a stump after recent amputation, as an incised wound, or granulating as an ulcer, a recent gunshot wound, a small puncture, an old sore, and lastly, a blistered surface.

For the particulars of these six aspects of Hospital Gangrene, I avail myself, chiefly, of Blackadder's original and valuable treatise.

(1) When a *stump* is affected, and the patient has a plethoric habit, or is accustomed to live freely, intense inflammatory action soon runs through its whole substance; swelling rapidly increases, so that in a few days the stump acquires more than twice its former size, and being much indurated, occasions the most excruciating pain. In this state the patient may become delirious, and die suddenly by effusion into some of the larger cavities. More frequently, however, gangrene seizes upon the integuments and cellular texture, large sloughs are thrown off, and some of the larger blood-vessels giving way, the patient sinks under the exhaustion of repeated hæmorrhage. For it is commonly found that the usual modes of stopping hæmorrhage from a stump are in such cases either inadmissible or totally inefficacious. Sometimes the progress of the disease in a stump is more *gradual*, yet ultimately nearly as fatal—*inflammation* is much less acute—there is comparatively little tumefaction, and the pain is far less severe; but the discharge is much more copious, and the cellular texture connecting the integuments and muscles is rapidly destroyed. Hæmorrhage generally supervenes later than in the preceding instance; it is, however, the most common cause of death. Sometimes, a stump, almost soundly *cicatrizied* to all appearance, will suddenly burst open and undergo gangrenous disintegration. Such cases are well described by John Bell.\* In one day he saw three stumps burst open, each of which had so nearly cicatrized, that you could have covered the small spot remaining unhealed with the tip of the little finger.

When this gangrene supervenes after any amputation, the case may be regarded as that of an *incised wound*, healing probably by adhesion, but suddenly diverted from primary union, and undergoing the aforesaid process of destruction.

(2) Observe the same gangrenous inflammation supervening on a healthy *granulating* wound, or ulcer.† The ulcer becomes painful and swollen, loses its healthy florid appearance, while the granulations, which were small and distinct, become flabby, and in some cases appear as if they were distended with air; in others, vesicles containing a watery fluid or bloody serum, have been observed, and the sensation in the sore has been described as resembling the stinging of a gnat. The secretion of pus is arrested, and the surface is covered with a tenacious viscid ash-coloured matter, which adheres firmly. After some time a discharge

\* Principles of Surgery, ed. Charles Bell, 1826, vol. i. p. 144.

† Observations on Hospital Gangrene, with reference chiefly to the Disease as it appeared in the British Army during the late War in the Peninsula. John Boggie, M.D., 1848, p. 42.

of thin ichorous matter ensues, a very peculiar cadaverous febrile smell, the pain increases, the edges of the sore are reverted, and generally assume a circular form; an erysipelatous redness encircles it, extending possibly to a great distance, even over a whole limb; the neighbouring glands, as those of the axilla or groin, swell, inflame, and perhaps suppurate. Omitting the constitutional symptoms thence arising, the local inflammation goes on apace, thin ichor continues to be discharged in great quantity, and a thick slough, apparently of coagulable lymph, like melted tallow, covers the whole surface of the sore, the fœtor is intolerable and the pain insupportable. At last an oozing hæmorrhage soaks the dressings, or a larger blood-vessel having sloughed, robs the patient of his last remaining source of strength, and the typhoid constitutional commotion soon terminates in death. Blackadder noticed that when the disease attacks a *large* recent wound, its whole surface may be affected at once; while in other cases, the gangrene commences on, or near, the lips of the sore.

(3) Passing from incised to *contused* wounds, "when," says this authority, "the disease attacks a *recent gun-shot wound*, the discharge, two or three days after contagion, is found to be lessened, and to have become more sanious than purulent. The sore has a certain dry and rigid appearance, its edges are more defined, somewhat elevated and sharpened, and the patient experiences in it a stinging sensation, as if occasioned by a gnat. Then, or a day or two later, the integuments at the edge of the sore become inflamed, and the surface of the sore itself assumes a livid or purple colour, and appears covered with a fine pellicle, such as forms on coagulating blood."

(4) "When," observes Blackadder, respecting hospital gangrene attacking a *puncture* or scratch, "the morbid matter is thus inserted, its first appearance resembles that of a part inoculated with *vaccine virus*." The primary inflammation begins at the end of the second, or early on the third day; it reaches its height about the sixth; but when the scab begins to form in one disease, *phagedænic* ulceration begins in the other, and if allowed to proceed soon affords sufficient proof of the non-identity of these diseases.

(5) Should the disease attack an *old sore*, where a considerable depth of new texture has been formed; a vesicle arises, filled with a livid or brownish-black fluid, which bursts and assumes the appearance of a small dark-coloured spot. Such vesicle, or spot, is usually situated at the edge of the sore. Phagedænic ulceration, spreading therefrom, makes comparatively very slow progress through the surface-bed of new texture, but having reached the subjacent natural texture, its progress is suddenly accelerated, acute inflammation supervenes, and a large slough forms.

(6) Lastly, when attacking the skin from which the *cuticle* has been removed, as by a blister, one or more small vesicles first appear, filled with a watery fluid, or bloody serum of a livid or reddish-brown colour. The situation of this vesicle also is generally at the edge of the sore. Its size is not unfrequently that of a split garden-pea, and is easily ruptured, the pellicle which covers it being very thin. If the vesicle contain a watery fluid, and has not been ruptured, its appearance resembles a greyish-white slough; if containing a dark-coloured fluid, or if ruptured, it appears a thin coagulum of blood, of a dirty brownish-black colour. During the formation of the vesicle a painful sensation in the sore is generally experienced, like that of a gnat stinging.

Thus the earliest and most elementary phase of Hospital Gangrene may be *vesicular*; just as gangrene generally begins, and senile gangrene in particular. The features peculiar to, and characteristic of, this so-called Hospital Gangrene, ensue *subsequently*—its slimy slough, its rapid progress, its appalling devastation. I shall presently have to notice one character which foretells all the rest, I mean *propagation by contagion*, and possibly by infection also, whereby the disease runs through a whole ward—a whole hospital if unchecked, passing from bed to bed with the rapid strides of death.

The *local results* to be anticipated are always sad, sometimes shocking. Among Blackadder's cases; in one, half of the cranium was denuded, the bones were black as charcoal, the integuments detached posteriorly to the second cervical vertebra; anteriorly, to the middle of the zygomatic process of the temporal bone; and this was originally only a superficial scalp wound. In another case, the integuments and cellular texture, on the anterior parts of the neck, were destroyed, and the trachea laid open, presenting a horrid spectacle. Among John Bell's cases, in one, the skin and muscles were carried away from the shoulder down to the bellies of the supinator muscles; and eventually, when the sloughing terminated, nothing seemed to be left of the arm except the bone, covered with a velvet-like surface of shining red flesh; and this was originally only a narrow splinter wound on the middle of the outer side of the arm. Continuing our course down the body; in one case, a very slight and superficial wound of the thigh grew into a sore, at first no bigger than the palm of one's hand; in two days as large as the crown of a hat; and in a week the whole skin of the thigh was destroyed, the muscles were stripped of skin and fascia from the hip to the knee, the trochanter was almost laid bare, the hamstring muscles were exposed to a considerable extent, and all the muscles of the thigh dissected in a manner which no drawing could express. With even these cases in view, imagination will scarcely realize the ravages of this gangrene. A tattered skeleton, still held together by ligaments? No; for the joints may be laid open extensively, and the knee, ankle, elbow, or wrist disarticulated.

*Constitutional Disorder.*—Long before any such irreparable injury has been inflicted, the constitutional powers take affront. The period, however, at which the constitution begins to exhibit symptoms of irritation is extremely irregular, sometimes as early as the *third* or *fourth* day, sometimes as late as the *twentieth*. The countenance assumes an anxious or feverish aspect; the appetite is impaired; thirst succeeds, and the tongue is covered with a white mucus. Some constipation at first, ends in diarrhœa. The pulse is rather irritated than accelerated. The general symptoms, however, have an inflammatory or typhoid character, according as the causes of either predominate. When an inflammatory diathesis prevails, the system becomes gradually more irritated, until acute inflammation attacks the sore, an event that frequently happens about the end of the second week. At this period the pulse is frequent and sharp, and not uncommonly the patient undergoes one or more shivering fits, succeeded by great increase of heat, seldom or never terminating in a profuse perspiration. The cold fit is sometimes followed by a bilious intestinal evacuation, with mitigation of the febrile disorder. If the local mischief be not arrested, weakness increases daily to exhaustion; the fever loses its inflammatory character, and unless the patient be cut off by hæmorrhage, he falls a victim to extreme debility. When the



disease has a typhoid character, the pulse is small and frequent, the appetite and strength gradually fail, not unfrequently diarrhoea supervenes, and the patient at length sinks, retaining his mental faculties to the last.

*Causative Relation of the Local and Constitutional Conditions.*—Whether does the constitutional disorder or the local disorganization precede? What is the order of succession; which is the cause; which the effect? Authorities are nearly equally divided on this question; but the weight of authority decidedly preponderates in favour of the local origin of hospital gangrene.

(1) *Local Origin.*—Blackadder affirms—"that in no single instance which I had an opportunity of observing, did the constitutional symptoms precede the local; unless the case be held an exception, where a stump became affected after amputation had been performed, on account of the *previous* effects of the disease.—That the morbid action could almost always be detected in the wound or sore previously to the occurrence of any constitutional affection.—That in several instances the constitution was not affected until some considerable time after the disease had manifested itself in the sore.—That when the disease was situated on the lower extremities, the lymphatic vessels and glands in the groin were observed to be in a state of irritation, giving pain on pressure, and were sometimes enlarged before the constitution showed evident marks of derangement.—That the constitutional affection, though sometimes irregular, was in many cases contemporary with the second, or inflammatory stage.—That when a patient had more than one wound or sore, it frequently happened that the disease was confined to one of the sores, while the other remained perfectly healthy, and this even when they were at no great distance from each other."

To these five arguments three more may be gathered from Welbank's well-known essay,\* forming so much additional support in favour of the local origin of this disease.—Thus the fact of its earlier stages being attended with little or no constitutional disturbance, was also noticed and urged by Welbank; and, "that when such disturbance does supervene, from the increased extent of the local malady, and unites in alliance doubly subversive of healthy processes of resistance, the latter stages of the disease are progressively accelerated.—That part of the diseased surface may clear off and granulate, while gangrenous disorganization continues progressive at the opposite edge.—That, however advanced the sore, it not unfrequently becomes healthy, and rapidly so, on the application of appropriate local measures;" and, "that the symptoms of general disturbance also which supervene are promptly relieved by measures that control the local condition."

Partly at variance with these facts and arguments, is the experience of Guthrie,† "That the febrile symptoms do seem to follow the appearance of the local alteration, is, in many cases, indisputable; that they precede or accompany the local symptoms in many other cases, is indisputable; and that the disease in a mild state, although capable of committing much mischief, is neither preceded nor followed by febrile or constitutional symptoms, cannot be doubted."

(2) *Constitutional Origin.*—On the other hand, there are, or have been those who affirm that the constitutional disorder generally, at least, *pre-*

\* Med.-Chir. Trans., vol. xi., 1820.

† Commentaries on the Surgery of the War in Portugal, &c., 1855, p. 165.



*cedes* the local disorganization. Thus, John Bell wrote :\*—The hospital sore is usually preceded by a degree of fever. Thomson—writing also from his own observations—states,† that these two classes of symptoms—the local and constitutional—are not invariable in the order of their appearance; for sometimes the one, and sometimes the other class, seems to occur first in the order of succession; but that the constitutional symptoms usually precede the local. Hennen also advocated this doctrine even more strenuously.

The question of local or constitutional origin may be further examined by reference to the known causes of hospital gangrene.

*External Causes.*—All observations respecting the etiology of this disease agree in certain particulars; that it is not developed epidemically, but rather as an *endemic*, springing up in some way among those who become affected. Thus, newly-built hospitals are free, so also are generally those built on high ground; while the disease arises in crowded and ill-ventilated hospitals.

*Infection.*—Thomson regards the disease as possibly infectious. "I have seen (says he) hospital gangrene introduced into an hospital by a single individual, and, when proper precautions were not taken, spread extensively among the other patients, but chiefly among those who lay nearest in the ward to the person originally affected or among those who had had most frequent intercourse with him. I have also known patients attacked in succession with hospital gangrene who had used the same bedding, or who, without using the same bedding, had occupied in quick succession the same small apartment." *Fomites*, therefore, can convey the infectious matter, and retain it some time. So highly infectious is this disease, according to Boyer's observation,‡ that it broke out in wounded patients, who, hoping to escape, had quitted the infected hospital, and retired to elevated situations where they breathed the most salubrious air.

The *infected distance*, or range of the contaminated air from the focus of infection, is unknown; but the disease certainly attacks patients at some distance apart (Thomson). Nor is the period of latency, after infection, more exactly determined. "I think (says this author), I have repeatedly seen the disease attack patients in less than three days after they had been exposed to its influence."

The production of hospital gangrene by infection seems to be disproved by Blackadder's observations, and chiefly by the result of the following experiment. He placed three patients with clean wounds alternately between three other patients severely affected. Their beds were on the floor, and not more than two feet distant from each other; but all direct intercourse was forbidden, and they were made fully aware of the consequences of inattention to their instructions. The result was, that not one of the clean wounds assumed the morbid action peculiar to the disease, nor was the curative process in any degree impeded.

*Contagion.*—This mode of communication can be traced as the *only* cause, in all cases since the days of La Motte, 1722, and Pouteau, in whose posthumous works, published 1783, hospital gangrene was first specially noticed. Pouteau observed that it may be communicated to the most healthy wound or ulcer in a person of the best constitution, and breathing the purest air, by merely placing in contact with any such

\* Principles of Surgery, ed. cit., vol. i. pp. 142, 147. † Inflammation, p. 458.

‡ Traité des Mal. Chir., tom. i. p. 322.

wound or ulcer, sponges, lint, &c., contaminated by contact with a sore undergoing the disease. Thomson concurs in the accuracy of this observation as well as advocating the infectious character of hospital gangrene. Delpech\* traced its propagation in almost every instance to the direct application of the morbid matter to the sores. Blackadder also recognised this mode of propagation in ninety-nine cases out of every hundred. Welbank arrived at a precisely similar conclusion. He speaks of the disease as being highly contagious by using the same sponges to different patients.† And Guthrie specifies this as one of the "conclusions"‡ of his observations during the Peninsular War. Nay more, that it is contagious through the medium of the atmosphere applied to the wound or ulcer.

Boggie's experiences§ during the same war compelled him to admit that hospital gangrene may be propagated by contagion, although he is disposed to attribute less importance thereto than to the continued operation of other local causes of an irritating character, in the shape of dirt, acrid applications, motion or mechanical irritation, attributing also considerable importance to other stimulating causes affecting the constitution; as hot weather, stimulating food, and the intemperate use of wine and spirituous liquors. In short, Boggie considers it inflammatory gangrene, and recommends antiphlogistic regimen.

While, however, admitting that all such causes may *predispose* to hospital gangrene, it does not arise in numberless instances where these and similar causes are conjoined in full operation. Their essential importance, therefore, cannot be allowed.

The etiology of hospital gangrene is so far obscure that its cause or causes, in the *first* instance of its occurrence, require further elucidation.

The general conclusion is this:—The disease may possibly arise from over-crowding in an ill-ventilated hospital or other institution; and is perhaps communicated by infection, from the sore itself emitting a poisonous exhalation; but it is assuredly also propagated by contagion.

*Treatment.*—Guided by the etiology of hospital gangrene, the nature of our *preventive* measures is at once suggested. When the *first* case appears in any hospital or other institution, our immediate object is to decompose the poisonous slough and discharge, and, moreover, arrest the progress of gangrene. Strong caustics such as will fulfil these intentions, should therefore be forthwith applied. Arsenic was originally recommended by Blackadder. The liquor arsenicalis, or diluted with an equal quantity of water, or with twice that quantity, was used, according to the emergency of the case. Strong nitric acid was first employed by Welbank. Either of these caustics, or even the actual cautery, should be applied until a new, hard, dry slough is formed, encrusting a clean and healthy surface. To prevent the *propagation* of this gangrene, punctilious cleanliness as regards the hands of the dresser, lint, water, and other appliances, should be daily observed in dressing all other wounds, even the most trivial and healthy. The bedding, also, should be changed, and clean linen furnished, as often as may be necessary to prevent their impregnation and the accumulation of fomites. Free ventilation and isolation of the patient will have similar preventive efficacy, and

\* Mém. sur la Complication des Plaies et des Ulcères comme sous le nom de Pourriture d'Hôpital, 1815.

† Op. cit.

‡ Commentaries on the Surgery of the War in Portugal, &c., 1855, p. 171. § Op. cit.

should not be neglected, although the disease may not be assuredly infectious.

*Constitutional* treatment must have reference to the combined state of irritation and debility; by the administration of opium, quinine, and stimulants.

The protective value of these measures has long since been fully established by their results. Thus, in military hospitals, the disease is apt to occur. Yet my own experience in respect of hospital gangrene, as it appeared during the late war, in the hospitals in the Crimea and at Scutari, does not approach what was formerly daily observed in *civil* hospitals. In the Hôtel Dieu, for example, it raged without intermission for two hundred years—so much so that “a young surgeon,” says an ancient French author, “who is bred in the Hôtel Dieu, may learn the various forms of incision, operations too, and the manner of dressing wounds; but the way of curing them he cannot learn. Every patient he takes in hand must die of gangrene.” Now-a-days, such scenes have passed away like a dream. This disease has not been witnessed for many years in the hospitals of this country, excepting on two occasions,—in the Middlesex Hospital, 1835,\* and in the University College Hospital, 1841.† With these exceptions, true hospital gangrene—contagious gangrene—has not reappeared; and many experienced surgeons of the present day have no practical knowledge of it whatever. The disappearance of a disease, once so frequent, once so formidable, can only be attributed to its causes having since subsided; and they are precisely the circumstances that have been specially obviated by the hygienic arrangements of the well-appointed and well-regulated hospitals of recent years; nevertheless, we are still bound to recognise hospital gangrene and to remember its etiology, as the best security for our continued observance of those protective measures which can alone prevent the recurrence of this disease in future.

## CHAPTER XI.

### POISONED WOUNDS.

#### HYDROPHOBIA.

HYDROPHOBIA is the constitutional disorder in the human species which arises from *contagion* with the saliva of a rabid animal.

Formerly, the reality of a *hydrophobic virus* was doubted, and even now-a-days the importance of a well-grounded belief on this starting-point must be obvious in relation to the appropriate means for preventing the consequences of the bite of a rabid animal. The dog and cat, and other animals of the canine and feline species, are peculiarly prone to hydrophobia; and there is abundant evidence to show that the bite of a “mad dog, cat, wolf,” &c., induces this disease by virtue of the *saliva* thus introduced.

The *wound* itself is often trivial—a mere scratch or graze from a tooth of the animal in the act of snapping; yet a very large proportion of

\* System of Surgery, Chelius, trans. by South.

† Lancet, 1845, vol. i., Lectures, Liston.



persons bitten by a rabid animal undergo hydrophobia, sooner or later, and die; and it is incredible to imagine that so many individuals, differing in their constitutional idiosyncrasies, should alike experience the same constitutional disorder, and that a fatal one, from a wound scarcely worthy of the name. The (morbid) saliva introduced by a scratch, itself trivial, is the only *peculiarity* of such lesion, and a very significant one. Many recorded facts, read in this light, become intelligible. Of fifteen individuals bitten by a mad dog, and attended at Senlis, by the Commissioners of the French Royal Society of Physic, ten were bitten on the naked flesh, and five through their clothes. Of the former, five proved fatal. Near Rochelle, twenty-four persons were bitten by a rabid wolf, and eighteen of them perished.\*

The existence of a hydrophobic virus, in the shape of a peculiar morbid saliva, has been also demonstrated *experimentally*. Several animals were inoculated with the saliva of a rabid dog, recently dead; a dog, a cat, a horse, and a cock were thus infected by Dr. Zine. Dupuy, in like manner, induced the disease by taking a sponge, which had been bitten by a mad dog, and rubbing it on the open sore of a sheep. Youatt drew a silk thread backwards and forwards through the mouth of a rabid animal, and having inserted it as a seton in the neck of a sound dog, this animal subsequently died of hydrophobia.

If, then, the inoculation of a peculiar virus be indisputably the cause of hydrophobia, is this disease capable of being conveyed by clothes impregnated therewith? Can it be communicated by *fomites*? Clearly so; for a dog's tooth is itself a fomes. To this effect, also, Mr. Trevelyan, writing to Dr. Bardsley, states that, after losing one pack of hounds by rabies, he not only removed the straw, but had the benches of the kennel scalded with boiling water, and afterwards all the joints painted and filled up with hot tar; the walls were then whitewashed, and the pavement cleaned with hot water. Thus secure as he imagined, he collected another pack; yet rabies again broke out and recurred year after year. In consequence of these continual attacks, he removed the pavement, threw the earth beneath into the river, refitted, new painted, and whitewashed the kennels; ever after which the pack continued perfectly healthy.

The *saliva* of a rabid animal being the source of hydrophobia by contagion, explains many things otherwise anomalous. This virus is usually introduced through a bite of the animal diseased, but the mere application thereof to ever so slight a wound, scratch, or other solution of continuity, in an *absorbing* surface, is sufficient. In such case, the lick of a rabid dog generally induces hydrophobia. The surety of inoculation will obviously be affected—by the number of wounds inflicted, by lodgement of the virus or its escape by hæmorrhage; and above all, by unobstructed inoculation through the naked flesh as compared with the protection offered by clothes. Apart from these modifying circumstances, in some cases no evil consequences ensue from the bite of a rabid animal, and the immunity enjoyed must be ascribed to some unknown peculiarity of constitution.

*Local Condition.*—Overlooking exceptional cases, hydrophobia ensues in a variable period from the date of the reception of the virus. The wound has generally healed, or it may not have healed quite soundly.

\* *Recherches sur la Rage*, Audry, ed. 3, p. 196.



In either case, slight pain of a rheumatic character shoots from the site of the bitten part to some distance; so that if the hand be the part first affected, the pain extends up the arm and shoulder, fixing itself in the trapezius muscle probably, or the proximate side of the neck. Sometimes a tingling heat, or even a sensation of cold, is experienced, rather than pain; but either sensation equally *extends*,—say, up the arm and shoulder. Generally, actual pain is felt, and eventually shooting towards the heart. Meanwhile the cicatrix swells, reopens, and discharges an ichorous matter. Occasionally no local symptoms occur; neither the customary radiating pain, nor any inflammatory condition of the cicatrix.

*Constitutional Disorder.*—After the lapse of some days perhaps, other and more formidable, because constitutional, disorder begins. The nervous system, together with its ally, the muscular, are the subject of all those phenomena which characterize this affection. The cerebro-spinal axis acquires undue susceptibility. Rapid-flowing thoughts, reviving memory, and fertile imagination, are expressed by a more animated manner and conversation; although, in some cases, a downcast pensive mien, yet withal irritable and peevish manner, prevails. Far more frequently, however, thoughts and fancies whirl through the brain tumultuously. A dull heavy pain caps the head and oppresses the temples, light is intolerable, and the slightest noise jars the whole frame; while sleepless nights or starting dreams, an overwhelming dread, muscular twitches, and pains in the neck, back, and limbs, complete the picture of morbid excitement—bordering on delirium. This state of comparative ease lasts only four or six days, possibly only a day or two; when the most remarkable symptom of true hydrophobia supervenes,—an *indescribable dread of fluids*; any attempt to drink—even the sight or sound of water, the thought of it, or anything associated therewith, as the noise of tea-cups, or of a pump—immediately excites a convulsive paroxysm, threatening suffocation. In some cases the slightest breath of air, a fly settling on the face, or a bright light, has the same effect.

These convulsive attacks are *paroxysmal* with *complete* intermissions. A viscid mucus accumulating in the mouth occasions an *incessant action of the lower jaw* to extricate it. The pains now piercing the epigastric and præcordial regions, more particularly, the general sensibility, becoming more and more acute, and the convulsive paroxysms more frequent, desperate and protracted, soon exhaust the patient's bodily power, while his mind is hurried on to *furious mania*; and thus, when fighting for breath, or utterly worn out, the poor sufferer expires. The second or third day usually brings this happy release. It may be postponed to the fifth or sixth day. Age makes some difference, for children endure not longer than twenty-four hours generally.

*Diagnosis.*—I have italicised those symptoms which, contrasting with the phenomena of tetanus, serve to distinguish hydrophobia. To these characteristics may be added two more;—the *early* period of *death* from rabies as compared with tetanus, and its *longer* period of *latency*. On this point, however, considerable extremes are recorded.

*Period of Latency.*—In one hundred and thirty-one cases, none of the patients became ill before the eleventh day after the bite, and only three before the eighteenth day. In two hundred and twenty-two cases, the disease showed itself eleven times before the tenth day; twenty-one, between the tenth and twentieth day; twenty, from three to six weeks; eighty-nine, from seven weeks to seven months; eighty-nine, from seven

months to twenty-seven months; one, after four years; one, after five and a half years. In Hamilton's table, it occurred in seventeen cases, between eighteen and thirty days; in sixty-three, between thirty and sixty days; in thirteen, between three and six months; in seventeen, between six and twelve months; in four, from ten to twenty months.

In both these series the period of incubation extended to between the third and eighth week. The extreme periods, as determined by Dr. J. Hunter, were thirty-one days and eighteen months. The most extensive and authentic observations accord about *forty days* as the *mean* period of latency in the human subject. Here, then, is a season during which *preventive* measures can be employed with the prospect of success.

*Treatment.*—Prompt removal of the hydrophobic virus by the cupping-glass, and free excision of the bitten part, constitute the most effectual preventative. In a part so situated that excision is impracticable, free cauterization may be resorted to, with strong nitric acid, potassa fusa, or nitrate of silver. It is impossible to say how late, in the period of incubation, these means would prove successful; for, if not employed in any given instance, some constitutional peculiarity might itself avert the super-vention of hydrophobia. There is just this poor chance of safety. But, considering the very large proportion of cases in which the disease does inevitably arise, no time should be lost. Excision, therefore, should be practised at the *earliest* opportunity, and not postponed, however long it may have been neglected; provided, of course, that in either case there be sufficient reason for believing or suspecting that the bite was inflicted by a rabid animal.

Before, then, resorting to a measure which entails permanent mutilation, more or less; the state of the *animal's* health in question should at once, if possible, be inquired into. The dog and cat chiefly concern us in this country. Rarely is the rabid state any approach to the popular notion of a "mad" dog. No wild excitement appears, no savage tendency to bite, and certainly no dread of water, so remarkable in the human subject. Rather will suspicion be aroused on ascertaining that the animal evinces only some strange departure from its usual habits and manner. In very many instances this peculiarity is a disposition to pick up straw, bits of paper, rag, thread, or any small object in the way. The animal laps water greedily. A disposition to lick is noticed in some cases, and particularly to lick anything cold—cold stones, or the cold nose of another dog; great aversion, however, to strange dogs and cats, especially to the latter, is very commonly observed at an early period. Some such *unusual* propensity is soon followed by an *irritable*, peevish manner. The animal snaps those about it, and resolutely fights if the least provoked, soon becoming furious. When thus obviously dangerous, it is forthwith secured. Yet a dog dangerously rabid may be perfectly quiet and natural, save in respect of some unsuspicious, because unobtrusive, symptom. Allowed to run about, patted and played with as usual, it bites in an unguarded moment. In *this* state, therefore, as well as when obviously rabid, the animal should be at once chained up. Instead of being killed, it can then be watched, to ascertain the real nature of its indisposition; thereby determining the necessity for excision in the case of any person who has been bitten. If the animal be affected with rabies, it will probably die in a few days; and this operation is imperatively demanded, as the only means of preventing hydrophobia in any of the human species who, having been bitten, would otherwise perish eventually. The safe

custody of the rabid animal will also effectually prevent further mischief being done during his short period of probation.

Supposing an animal, not itself rabid, or bordering on that condition, to have been bitten—a healthy dog, bitten by another dog, decidedly rabid. The latter will, of course, be killed; but when may the former apparently healthy dog be allowed to go free? This question, bearing directly on the spread of rabies among animals, bears equally on the prevention of hydrophobia in the human species, by eradicating the source of this disease.

The question turns on the period of latency among *animals*. In the dog it is considered to terminate about the end of the sixth week. At the Veterinary School, Alfort, when a dog is bitten, it is chained up for fifty days, and, if healthy at the end of that period, is restored to its master. Mr. Samuel Cooper used to mention in his lectures, at University College, an instance of a more extended period than that which regulates the preventive measure adopted at Alfort. A large Newfoundland dog, having been bitten by another dog, did not become rabid until seventy days had elapsed; information the more valuable, since Mr. Cooper himself watched the case from beginning to end. In Lord Fitzwilliam's pack the disease appeared at various intervals, from six weeks to six months.\* We may therefore conclude, that an animal bitten by another in a rabid state should be chained up for a longer period than the experience at Alfort would suggest as an adequate preventive injunction—imprisonment for six weeks.

Preliminary to this question is another—the *communicability* of hydrophobia or rabies among animals and man,—a consideration essentially relating both to its propagation and prevention. Many facts tend to show that the communicability of this disease depends on the inherent capability of the animal affected to *engender* it spontaneously; failing which, he may bite in vain. The dog can generate rabies, and therefore can communicate it to another animal, or to man, in the shape of hydrophobia. Sheep, horses—the herbivora—and man cannot generate the disease, and therefore cannot communicate it. Thus, rabies in a flock of sheep, consequent on the bite of a rabid dog, is not communicated from one sheep to another, although the sound are often bitten by the diseased, and in parts stripped of wool (Dupuy). At the Alfort Veterinary School three sound sheep, two dogs, and a horse were inoculated with the saliva of a rabid horse; not one of them became affected. In keeping with this view, man cannot communicate hydrophobia. By the experiments of Vaughan and Babington, animals were inoculated with the saliva of hydrophobic patients, but without any effect. In an exceptional experiment by Magendie and Breschet, one dog of two thus inoculated became affected; but this animal might have been previously diseased, especially as rabies was rife at the time. Paroisse inoculated three dogs with the saliva of a man in hydrophobia; the animals were kept and watched for nearly four months afterwards, during all which time they remained quite unaffected. Similar experiments were conducted by Gauthier, Giraud, Girard, and Bezard, with the same negative results. Lastly, there is no instance of one human being acquiring hydrophobia from another labouring under this disease, although in many instances attendants have been bitten by such persons.

\* Morbid Poisons, R. Williams, M.D.



In conclusion, the general inference to be drawn from these facts is this—that in estimating the danger to human life incurred by the liberty of rabid animals, those only which can generate rabies—*e.g.*, the dog—are dangerous. The human species affected with hydrophobia is harmless, should there be any tendency to bite.

Such considerations, coupled with a due knowledge of the duration of latency in different animals, particularly the dog, suggest adequate precautionary restraint; while, in the event of hydrophobic virus having been communicated to man through the bite of a rabid animal, the prevention of the disease then impending is fulfilled by free excision of the part bitten, as soon as possible, aided, if necessary, by cupping.

*Curative* treatment will be utterly useless, although it may be possible to palliate symptoms and prolong life. This may perhaps be effected by the plan of treatment recommended by Marshall Hall and Todd. It consists in removing all causes of irritation, bodily and mental, as by placing the patient in a darkened room, excluding any draught of cold air, all noise and conversation. The application of an ice-bag along the whole length of the spine seems to have some influence in allaying the excitability of the cord; while stimulants and nourishment support the patient in the exhaustion consequent on the convulsive paroxysms.

**SNAKE-BITES.**—Of Poisoned Wounds, in the ordinary sense, the bites of venomous snakes, happily of rare occurrence in this country, possess much surgical interest; chiefly with the view of preventing their constitutional effects, rather than the more hopeless intention of curing them. The local effect of a poisoned wound is essentially *cellulitis*; inflammation of the subcutaneous cellular texture, announced by acute burning pain, accompanied with some, and perhaps, subsequently, enormous diffused swelling, not at first involving the skin. In severe cases the swelling spreads rapidly, and to an almost unlimited extent, so widely may it range.

The bites of the rattlesnake and of the cobra di capello answer to this general description.

*Local condition.*—A piercing pain is immediately felt, rapidly shooting through the limb; swelling quickly succeeds, and a mottled livid redness, indicating that the skin is now involved. The cellular texture of the whole limb, and perhaps down the proximate side of the trunk, becomes gorged with a bloody sanious fluid; and, as if to relieve this tense yet diffused swelling, phlyctenæ arise here and there. Very shortly the pain abates, the tension is exchanged for a flaccid softness, the limb is cold and benumbed; while patches of gangrenous skin announce that the work of destruction has commenced, not however disclosing the ravages already wrought beneath the skin in the subcellular texture, and still less the extent to which it may eventually be sacrificed.

*Constitutional Disorder.*—Rapidly as all this mischief is accomplished, the constitutional disturbance begins almost concurrently with the first introduction of the poison. Soon after the poisonous bite has been inflicted, symptoms of muddling intoxication ensue. The victim mumbles incoherently, and staggering, as if dead-drunk, is overcome with helpless prostration and oppressed breathing. Other and even peculiar symptoms are witnessed. Profuse cold sweating, bilious vomiting, and perhaps evacuations of bile; while a yellow hue overcasts the skin. Excruciating pain about the navel is sometimes experienced. The pulse quivers irregularly, the nervous system succumbs to the potent poison, and the sufferer expires.



Now, in order to prevent this fatal issue, and, moreover, the formidable antecedent symptoms, remember the poison begins to operate almost immediately, varying in this respect, however, with the dose. Still its period of latency is short.

*Period of Latency.*—In one case—carefully recorded by Sir E. Home\*—a man was bitten by a rattlesnake at half-past two P.M., and brought to St. George's Hospital, by three o'clock; during this brief period of only half an hour the constitutional disturbance had become overwhelming; and in the interval, when the man went of his own accord to a chemist's shop for relief, he was observed to stagger, and appeared drunk. Death ensued. In another instance,† the bite of a rattlesnake began to manifest its effects within the first half hour.

*Treatment.*—If we assume the period of latency to be *under half an hour*, preventive measures should be very promptly employed. The poison may be removed from the bitten part, or arrested before entering the general circulation or neutralized. The application of a cupping-glass, or excision, are calculated to withdraw the poison; a ligature above the part affected, fulfils the second purpose; caustics, the actual cautery included, the third purpose. Of these appliances, that of cupping is most efficacious and practicable, if not the only one of value.‡ Diffuse inflammation consequent on the introduction of the poison, must be treated by free incisions and fomentations. Curative treatment has very little effect in overcoming the constitutional condition of utter prostration. Stimulants, such as brandy, wine, or ammonia must be freely administered. Arsenic, in large doses, has been recommended as a specific. Such is the "Tanjore pill," a famous Indian remedy. But its efficacy is doubtful and even perilous.

MALIGNANT PUSTULE OR CHARBON, is also communicated by *contagion*, the poisonous matter being caught directly from beasts, or their remains; for the disease is not propagated apparently by the human species, from one individual to another.

*Local condition.*—Soon after any accidental inoculation with the morbid matter, a stinging sensation is felt, and a red point appears, hardly elevated above the skin. Then, at this point, the cuticle rises into a blackish vesicle, which speedily runs into a slough, surrounded by an œdematous swelling, having a violet tinge, and spreading rapidly in all directions. Occasionally, neither vesicle nor pustule arises, only swelling. Such was the character of the disease in three cases observed by Lawrence.§ With obvious swelling, however, a sensation of tension, rather than pain, is experienced. Should several pustules arise, the disease is proportionately more perilous, and especially if situated on the neck or face; for then the swelling may be so considerable as to threaten suffocation or congestion of the brain. Indeed, malignant pustule is not unlike carbuncle in appearance, but differs from it in being always the result of contagion. And this etiological consideration will always determine the diagnosis.

*Constitutional Disorder.*—A variable period having elapsed, the constitutional symptoms supervene. Fever, attended with pain over the stomach and vomiting, is soon succeeded by delirium and prostration.

\* Phil. Trans., 1810.

† New York Med. and Phys. Journal, vol. ii.

‡ Experimental Researches on the Influence of Atmosp. Pressure on the Blood in the Veins, and on the Prevention and Cure of the Symptoms caused by the Bites of Rabid or Venomous Animals. D. Barry, 1826.

§ Lancet, 1825-6, p. 127.

The causative relation between the local lesion and this constitutional disorder is shown by their invariable sequence. The latter always follows the former; and, moreover, it is very doubtful whether the constitutional disorder can be induced by contact with the same morbid matter, unless succeeded by the formation of malignant pustule. This local lesion, therefore, would appear to be the *only* cause—the only mode of origin, of the constitutional morbid condition.

The nature of the morbid matter itself is unknown, but it is developed in beasts affected with “contagious carbuncle.” The poison may be imparted by any accidental inoculation, in handling the animal when alive, or during the manufacture of hides, wool, &c. Malignant pustule is consequently most rife among butchers, tanners, shepherds, and wool-beaters. It may also be produced by eating the flesh of animals thus diseased. Instances in proof of this mode of production are cited by Wagner and Turchetti. Temperature and moisture have apparently some influence, for the disease is most prevalent in damp localities, and in wet autumnal weather. The morbid matter—whatever it be—retains its poisonous power for a long time; but the disease is probably not propagated by the human species, from one individual to another.

*Treatment.*—Preventive measures are obviously suggested in accordance with the known etiology of this disease; although in the pursuit of certain avocations it may be difficult so to protect the hands and exposed parts of the body so as to escape contagion. Even then, however, this preventive opportunity remains; the progress of malignant pustule can generally be arrested at its commencement by excision or cauterization.

GLANDERS is another disease derived by contagion from certain *animals*—the horse, ass, or mule—similarly affected.

Inoculation of the human species is apt to occur by handling either animal when glandered; and the constitutional disorder thence arising may be briefly described as fever, resulting in the production of many inflammatory tumours in different parts of the body, which have a great tendency to suppurate and fall into gangrene. Towards the close of glanders, in 11 of 15 cases (Rayer), puriform mucus, mixed with blood, oozed from the nostrils; in 10 of these cases, the discharge came from one nostril only; and in all cases the quantity was inconsiderable, sometimes scarcely appreciable. The eyelids, also, are tumified, and secrete a thick viscid mucus. This disease runs its course in a period varying from a few days to many months.

Its *period of latency* in man varies from two to eight days.

*Treatment.*—I am not aware of any means whereby the progress of glanders can be arrested when once inoculation has taken place, however early our intended preventive measures may be applied. If in this respect unlike the bite of a rabid animal, a snake-bite, or malignant pustule, glanders has at least one advantage—the disease can always be *avoided*.

As bearing on the question of prevention, the early and exact diagnosis of glanders in *animals* is important. It is communicated to man by an animal in a state of disease so obviously characteristic that the danger cannot be overlooked.

Two varieties of this disease, in the horse, ass, or mule, are recognised by R. Williams. In *gangrenous* glanders, the animal immediately loses its spirits, and staggers; the nasal and conjunctival mucous membranes are beset with a number of red points, which at the end of twenty-four to

forty-eight hours, become livid; the nostrils now discharging a yellow matter, streaked with blood. This condition lasts two or three days; then the nasal membrane falls into gangrene, and large ulcers form where portions have sloughed. The discharge increases and exhales a fœtid gangrenous odour; œdema of the nostrils, scrotum, and legs soon supervenes: at length, the nostrils being glued together, respiration fails, and the animal dies. In *pustular* glanders, the same general debility and fever are observable as in gangrenous glanders. The specific inflammation of the nasal membrane is an eruption of pustules, said to resemble confluent small-pox, followed by a copious yellow viscid discharge from one or both nostrils. After two or three days, these pustules ulcerate, sometimes internally, so as to destroy the bones and cartilages of the nose. By absorption of the nasal morbid secretion, the sub-maxillary glands become swollen and tender, but only on the inflamed side of the head. Such enlargement is called the "kernels." Œdema of the nostrils, the sheath, and hind limbs succeeds, as in the gangrenous variety; and respiration failing, death ensues on the eighth or tenth day, at latest.

Glanders is often accompanied with "farcy," and farcy often ends in glanders.

*Button farcy* is characterized by inflammation of the cellular texture, forming tumours in different parts of the body; the head, neck, and extremities, particularly the hind legs. In four or five days they soften and ulcerate. It is an inflammation of the lymphatic glands and vessels, usually beginning in the hind extremities, attended with lameness, and forming an irregular swelling of the limb, which at length ulcerates and discharges a sanious fluid.

The *period of latency* in glanders affecting *animals* is generally short. Two asses—one about a year old, the other about a year and a half old,—were inoculated by Turner. In the former the maxillary glands became tender on the second day, and the discharge from the nostrils was established on the following day. In the latter the maxillary glands enlarged on the third day, but the nasal discharge did not appear until the sixth day. In a horse inoculated with farcy matter, the disease did not appear until the end of three months, and then precisely at the points of puncture. Gerard states that he introduced the matter of the discharge every day, at different times, into the nostrils of certain horses by means of a brush, and that the disease appeared on the seventh day, but in two others not until the thirty-second day.

Fortunately, however, glanders is not an eminently *contagious* disease, either from one animal to another, or from this source to the human species; and its *communicability* from one human being to another is very doubtful. A case once apparently occurred in St. Bartholomew's Hospital:—a healthy nurse contracted disease from a glandered patient, and she died after a short illness, having every symptom of glanders.

Assuming that glanders can be readily detected and distinguished from all other diseases, the prevention of its *first* propagation will consist in forthwith destroying the diseased animal from which, as the centre of contagion, it might spread. This preventive precaution is not alone sufficient protection to man or beast. The disease is communicable by *fomites*, as well as by direct inoculation from one animal to another. In this way, some of the discharge from the nose of a glandered horse having remained about the manger, rack, or partition of a stable, may be thawed by the breath of a new horse, or introduced into the system in the act of



nibbling or licking, whereby sound horses have speedily become glandered when put into a stable whence a glandered one had been taken weeks or months previously—thus reviving the disease, and with imminent peril to grooms and others in attendance. “Let, then,” says Youatt, “the halters, head-gear, and bridles be burned; the clothes washed and baked; the pails newly painted; the racks and ranges thoroughly scraped, then washed well with soap and water, and afterwards with chloride of lime and water, in the proportion of a pint of the strong solution to a pail of water; let the walls be well scraped and washed with the chloride of lime and water, then well lime-washed; the floor be first thoroughly scoured, then sluiced with the chloride: and, with all these precautionary measures, every possibility of danger will be removed.”

## DISEASES OF THE NERVOUS SYSTEM.

### CHAPTER XII.

#### SHOCK OF INJURY.—COLLAPSE.

**SHOCK.**—*Symptoms, and Diagnosis.*—Failure of the heart's action, or cardiac syncope, is the immediate effect of any sudden and violent impression on the nervous system. This failure of function is denoted by a thready, feeble, yet frequent and perhaps irregular, pulse; which is accompanied with pallidity, a cold clammy skin, haggard look, and lacklustre eye, great muscular prostration, soft sighing respiration, and, perhaps, some cerebral disturbance; symptoms which constitute the state known as Shock, or Collapse as arising from Injury. Other symptoms are exceptional and occasional only. Hiccup, vomiting, relaxation of the sphincters, attended with involuntary micturition and defæcation; suppression of urine, convulsions, and stupor.

It thus appears that in this state of functional suspension, both the nervous and blood-vascular systems are overwhelmed, involving possibly, all other functions; but, as the shock of Injury, the nervous system is primarily affected, and *thence* the vascular system; thus differing from cardiac syncope consequent on hæmorrhage. A great physiological relationship underlies the pathology of Shock;—namely, that while the action of the heart is independent of the nervous system, it is much influenced and even arrested by any impression through that system. Not unfrequently, however, with Injury, *both* modes of origin,—nervous suppression and loss of blood, co-operate.

*Causes—Injuries* of all kinds—*e.g.*, incised and lacerated Wounds, Burns, Fractures, and Dislocations—are attended with Shock; and according to their *extent* as involving the nervous system, and their *persistence* as causes in operation. A burn, superficial in itself, but extensively involving a considerable cutaneous expansion of the nervous system, will cause more extreme shock than a far deeper burn of limited nervous consequence. Unreduced Fractures and Dislocations continue to operate, by laceration and pressure, on the nervous system. But injuries of organs, abundantly supplied with nerves, or in intimate relation with the



nervous system, are equally influential. Thus, crushing of the testicle, or lesion of an internal organ, may prove fatal.

Simple shock, without any apparent structural damage, may be equally deadly. A blow, for example, over the epigastrium; or pain, intense and prolonged; a stroke of lightning or exposure to cold. Certain poisons, probably, have an action resembling Shock; such are powerful sedatives, as tobacco, and powerful purgatives.

Mental emotion may operate in like manner. Fear, or bad news, will cause the heart to sink in a moment, accompanied with the pallor of collapse; while, a depressing passion, such as grief, weighs it down more permanently.

*Predisposing* conditions are, perhaps, very influential. Impressibility to the causes of Shock is, however, not an indication of its continuance; but generally inversely proportionate. Thus, shock may be easily occasioned, yet soon pass off, as in *youth*; or not so readily occasioned, and yet persistent, as in *old age*. *Premature age*, by intemperance or sexual excess, is peculiarly unfavourable. *Constitutional susceptibility* is well marked, in the shock of some individuals; but it requires all the experience and judgment which the Surgeon can bring to his aid, to foresee this peculiarity. I remember removing a great toe-nail, under the local-anæsthetic influence of ice and salt; the patient being a robust, ruddy-complexioned young woman. She sat up during the operation looking at her foot, and experienced no pain then, nor much afterwards. Yet no sooner had the circulation in the toe returned, than she became blanched and cold, and subsequently fainted—alarmingly several times.

*Terminations.*—(1) A *fatal* termination may ensue almost immediately, and unexpectedly. I have seen a patient with severe compound fracture just removed to bed, restlessly attempt to raise himself once or twice, and then drop dead on the pillow. The heart's action is paralysed through the impression on the nervous system.

After death, the heart is found engorged with blood; all its cavities being distended, especially the right auricle and ventricle. The venous system, generally, is similarly distended. Coagulation has taken place to some extent, but imperfectly; a considerable portion of the blood remaining fluid, while the clots are loose and dark. Sometimes the blood is altogether fluid. Rigor mortis commonly occurs, and sometimes very strongly. A significant fact is the accumulation in the stomach, of any food which may have been taken, and that it has undergone little or no change; thus indicating the suspension of digestion, in common with other functions which can be observed during life. I have also frequently found the intestines comparatively empty, and singularly enlarged, owing apparently to atony of their muscular coats. Beyond these appearances there is a remarkable absence of any discoverable lesion apart from the injury itself, which has occasioned the shock. Considering the known dependence of all function on structure, it is highly probable that some molecular disintegration of nerve-tissue has occurred, which has hitherto eluded observation. This would not be inconsistent with the speedy recovery in many cases, by any such structural disorganization having returned to a healthy state.

(2) *Reaction.*—A natural restorative effort commonly ensues, in a period varying from a few minutes to thirty-six or forty-eight hours, or more. This reaction, as it is termed, of course implies the revival of those functions which have been temporarily suspended. The balance

of the circulation is regained, the pulse acquiring force and fulness, and losing its frequency and irregularity. With it warmth returns, and the colour of the living body reappears. Respiration becomes more perceptible, prostration is less marked, the individual evincing some inclination to turn from the supine posture, and the cerebral obscurity clears off. Ordinarily, I think, reaction is not a continuous restorative effort; but slight retrogressions towards collapse occur, followed by reactions progressively more and more complete; and it is by this series of ebbings and flowings, that the balance of the circulation and other functions is at length regained.

If revival be incomplete, a mixed state of exhaustion, with reaction, prevails.

*Prostration with excitement*—as this state was first named by Mr. Travers—is distinguished by a rapid bounding pulse, but weak and liquid. The skin is hot and the face flushed, but there is still a haggard expression. The breathing is hurried, and irregular, there is much restless tossing about, and perhaps spasmodic action of the muscles, with great debility, and the mind becomes excited and bewildered. The patient now dozes off, then flickers up, as it were, suddenly, with an agitated and tremulous manner, only again to wander, and again arouse. At length frenzy, possibly, subsiding in coma and re-exhaustion, with a cold clammy sweat, ends in death; or ultimately, reaction prevailing, the pulse regains its force, loses its frequency, and the healthy status is slowly re-established.

*Remote* constitutional consequences are said to occur after the shock of injury; resulting perhaps in sudden death, some weeks or months after apparent recovery. Hodgkin and James have directed attention to these consequences; but it is very difficult to connect them as such with the original shock.

The *prognosis* of shock is always precarious and uncertain. It will depend very much on the causes, immediate and predisposing, already mentioned. And here individual predisposition is a highly important criterion; and especially the natural calmness and hopefulness, or the irritability and despondency, of a patient. Watchful nurses recognise these distinctions in *their* prognosis, as well as surgeons. The explanation is obvious, that mental dispositions are not only predisposing, but also *persistent* and therefore maintaining causes of shock. Persistent conditions of bodily injury are likewise unfavourable. *Extent* of injury indicates rather the immediate intensity of shock, than the probability of its continuance.

*Treatment*.—This also should have reference to the cause or causes of shock. Some are slight and transient, and thence reaction soon follows. Others again are more severe and perchance persistent; whereby the shock being proportionately more intense and lasting, reaction is delayed, and imperfect. The removal of any cause still in operation is, therefore, obviously of primary, and in a measure, of preventive consequence. Hence, the reduction of fracture or dislocation, of strangulated hernia, and even the amputation of a severely injured limb, are of vital importance, in the treatment of shock.

Remedial measures take effect in proportion to the natural tendency to reaction, and this—apart from the continued operation of causes—is not immediate. The patient should be placed in the recumbent position, and stimulants administered to further aid the returning circulation.

Warm tea for children, brandy or ammonia and water for adults, may be given, provided the patient can swallow; otherwise, with insensibility, the fluid may pass into the larynx and cause suffocation. Watching the effect on the pulse, stimulants must be repeated from time to time as occasion requires. Volatile ammonia held to the nostrils is temporarily restorative, but it may be thus administered when fluids cannot be swallowed. Then also, a stimulating enema, of turpentine for example, will be an advantageous mode of stimulation. In all cases, warm blankets, hot bottles to the feet and epigastrium, and perhaps galvanism, are available and effectual. The possibility of over-stimulation, by any of the means employed, must not be overlooked; remembering that sensation, for a time, is in abeyance, we should, as Professor Miller expressed it, "feel for the patient." In apparently *hopeless* cases, artificial respiration, patiently continued, may be resorted to with success. Opening the external jugular vein, is recommended by Mr. Savory, in consideration of the engorgement of the right side of the heart and venous system. Collapse from the loss of blood by hæmorrhage from any cause, suggests the employment of "transfusion," as the special means of meeting this emergency. Nourishment also, to supply the loss of blood, is a more immediately urgent requirement than in ordinary nervous shock.

*Excessive* reaction must be met by opiates rather than blood-letting; the fever being nervous more than inflammatory. The substitution of light nourishing food for mere stimulants, will be found advantageous; for there is still a strange mixture of exhaustion with *such* reaction.

*Prostration with excitement*,—or the more pronounced phase of this condition, requires similar treatment. The quantity of opium borne with impunity, and eventually proving remedial, is often surprising. Grain doses of solid opium or equivalent doses of the tincture, may be administered repeatedly, at intervals, according to the symptoms; and with stimulants, in kind and quantities, also according to the symptoms, and the previous habits of the individual. Nourishing food should, as soon as possible, aid or supersede these more immediate resources. Not unfrequently, however, any food is almost rejected by a sort of hiccupy vomiting, a symptom which is in itself distressing to the patient. Small pieces of ice swallowed occasionally may afford some relief; and hydrocyanic acid, or creosote, are sometimes more useful.

The question as to the performance of a *Surgical operation during Shock*, is determined by two considerations;—the persistence, or not, of any cause in operation, as, for example, a bad compound fracture; and, secondly, the pathological fact, that the nervous system and circulation *already* in the state of Shock, is less susceptible of further shock than after reaction. An almost *immediate* surgical operation thus forms part of, and joins issue with the injury, for which it is performed. *After* that period of juncture, it is better to make a compromise with the vital powers, by waiting for *incomplete* reaction.

*Chloroform*, is detrimental, in proportion as Shock prevails, and equally useless, owing to the comparative insensibility of the patient.



## CHAPTER XIII.

## TETANUS.

TETANUS (*τείνω*, to stretch) signifies a violent and involuntary contraction of the voluntary muscles, attended with severe pain and rigidity.

*Symptoms, and Diagnosis.*—The spasmodic contractions having commenced, never entirely relax throughout the course of the disease; they are *tonic*, thus distinguishing them from intermittent or *clonic* spasms in ordinary convulsions, as in hysteria or apoplexy; and complete consciousness is retained to the last, this additional characteristic distinguishing the tetanic from clonic spasms in epileptic convulsions, and from those of hydrophobia.

Tetanus approaches and proceeds by the following series of spasmodic contractions, each persisting in the order of their succession. Stiffness is first experienced about the root of the tongue, which is usually retracted. Articulation therefore is imperfect. A sense of painful rigidity in the posterior muscles of the neck, and some difficulty in moving the jaw, are soon experienced. If the jaw be fixed, and tetanus proceeds no further, it is known by the name of *trismus*, or lock-jaw. Generally speaking, other sets of muscles become involved. The facial muscles are convulsed; the angles of the mouth being drawn up, presenting a peculiar expression, the “tetanic grin” *risus sardonicus*. Deglutition is accomplished with great difficulty, and fluids are convulsively ejected when any attempt is made to swallow them. In this particular, tetanus resembles hydrophobia. Even the sight of fluids may occasion dread,—another point of resemblance. Yet in no other respect is there any similarity between these diseases. No foaming at the mouth of a thick mucus, with constant movement of the jaw to extricate it, is ever witnessed, as in hydrophobia. Other peculiarities supervene. Pain strikes through the body from the ensiform cartilage backwards to the spine, and being accompanied with intense spasm of the diaphragm, occasions agonizing dyspnoea, which has been compared to that of hydrophobia. Very soon the muscles of the back contract, and with such violence that the body is drawn into the form of an arch resting on the head and buttocks (*opisthotonos*); or the abdominal muscles contracting, become as hard as a table, and draw the body forward (*emprosthotonos*). During these spasms, the rectus muscle has been torn with the violence of its contractions. The body is sometimes bent to one side (*pleurosthotonos*). Next in order, the muscles of the lower extremities are involved; and lastly, those of the upper, excepting the fingers, which generally remain moveable to the last. The tongue also is rarely involved, although it may be thrust violently against the teeth and be much lacerated.

Such is the ordinary course of events in Tetanus. They constitute one continued manifestation of spinal excito-motion, without suspension of the cerebral functions; but, as would be expected, the tetanic spasms—violent and continuous—provoke general disturbance of the *organic* functions. Thus, the respiration being much embarrassed, the heart beats more quickly and forcibly, giving to the pulse similar characters;



but they are eventually succeeded by feebleness and irregularity. The urine is perhaps scanty and high-coloured, and is sometimes retained or voided in small quantities, while the skin pours forth abundantly a sour-smelling sweat. Lastly, obstinate constipation is a constant and significant symptom throughout this disease; and should an evacuation occur, it is singularly offensive. "I remember," says Abernethy, "on one occasion, asking an old nurse what sort of evacuations had come from a tetanic patient, who for a week had no relief from the bowels; 'Lord, sir,' she replied, 'they are not stools, they are sloughs.'"

The *diagnosis* of tetanus is not always clear. I have already noticed how it differs from hydrophobia, epilepsy, apoplexy, and hysteria. But it may resemble the latter disease. *Hysteria* with spasm.—Hysterical tetanus may occur in females, and present a wonderful likeness. No fatal case is recorded. According to Dr. Copland; in females, trismus or subacute tetanus may assume an hysterical character, or hysterical symptoms may be associated with the tetanic, the disease being really tetanus and occasioned by an injury. Certain *drugs* produce convulsions, resembling those of tetanus. *Strychnia*, is thus specially deceptive. But the tetanic spasms, produced by strychnia, are remittent or intermittent, and subside entirely as the poisonous influence passes off, or kill in the first onset if the dose or doses be sufficiently potent. All these points of distinction were observable in the case of Cook, and were successfully urged against Palmer in the celebrated trial for the murder of that man. *Morphia* sometimes produces convulsions, but they are epileptiform, and long in their development.

**VARIETIES.**—Sometimes trismus and general tetanic twitches supervene on continued prostration, and remaining associated with it, constitute a variety of "*prostration with excitement*." The excitement is *tetanic*. Such were the phenomena I observed during the course of a severe burn, under the care of Dr. A. Marsden in the Royal Free Hospital. The burn extended over the toes and instep of the right foot and lower part of the leg. Its depth was to Dupuytren's fifth degree. The annular ligament was destroyed, the interior of the ankle-joint exposed, as also were the carpal bones, and the nails were burnt away. An attempt was made to save this foot, which would, I believe, have proved successful, with the removal of portions of bone; but the patient, a middle-aged woman, was fat and flabby, and a hard drinker. Prostration continued, and in a few days partial trismus, with tetanic twitches of the arms and hands, set in. The patient's mind wandered; she frequently raised her head, uttered a few words, and then dropped on to the pillow, turning her eyes right and left with restless agitation. I suggested to Dr. Marsden, who was good enough to ask my opinion, that amputation might be deferred, and that a grain of opium, with ten grains of castor, be given every four hours. The trismus never became complete, nor the tetanic twitches more general; but this condition lasted for more than a week, with continued prostration, when the woman died exhausted.

In other cases of continued irritation *pure* tetanus supervenes. A man died of universal tetanus in a few hours after an oblique fracture of the thigh-bone, which penetrating the rectus muscle, was continually playing through the belly with a see-saw\* motion. A man having a simple fracture of the femur, and who appeared to be doing well for four days, was seized on a sudden with lock-jaw, and died in three days of acute

\* Constitutional Irritation. A further Inquiry, 1835. Travers, p. 292.

universal tetanus. Examination showed that the upper fragment of the bone, obliquely fractured, had perforated and left a detached spiculum of considerable size transfixing the vastus internus muscle.\*

Certain varieties are noticed by Mr. A. Poland, in his elaborate article on Tetanus.† *Spasms primarily attacking the muscles of the part injured*, instead of the muscles of the jaw. Two cases are mentioned, both of which were fatal. In the one, two months elapsed, before the first symptoms occurred, a neuralgic affection of the muscles of the ball of the thumb, without any appearance of inflammation. The injury, originally, was a lacerated wound of the fleshy part of the thumb, by a splinter of teak-wood, which had transfixed the part. This was withdrawn at the time, and the wound healed soundly. But, after death, two pieces of splintered teak were found imbedded in the abductor muscle, and resting on a branch of the radial nerve. The other case, was occasioned by a blow of a schoolmaster's cane on the hand. In this instance, both pain and spasm commenced in the injured part; followed by a gradual spasmodic contraction of the flexor muscles of the hand, drawing the fingers into the palm, and subsequently extending to the arm and other parts. *Absence of pain* was characteristic of one case, even to the last moment of existence. The cramps were accompanied by a tingling and agreeable sensation, with a strong tendency to laughter. *Special affection of the muscles of the face and eye*, was noticed in three cases, simulating ptosis in two of them. The muscles of the eye are sometimes affected; the eye-ball being fixed and drawn slightly inwards. The pupil may be contracted or dilated. *Cerebral complications* are very rare; but delirium may supervene towards the close of tetanus. *Epilepsy* is another quite exceptional complication, in a patient subject to this disease. Screaming and convulsions, apparently not epileptiform, may occur. *Motor-paralysis* occurred in two cases of the seventy-two, in Guy's Hospital, from which the above results were gathered. *Remission of the symptoms* is extremely rare, yet it has been noticed in several instances. In one case—according to Dupuytren—tetanus subsided for twenty-eight days, and then returned after an exposure to cold.

All these anomalous forms of tetanus are worthy of notice, as bearing on the, possibly obscure, diagnosis of this disease.

*Pathology.*—Until recently, the pathological anatomy and interpretation of the functional or pathological phenomena of tetanus, were involved in great obscurity. And although the essential nature of this disease may yet require further elucidation, and especially by a more extensive assortment of *post mortem* examinations; the original researches of Mr. Lockhart Clarke‡ have brought to light a series of structural changes in the spinal cord, which are of the highest importance.

In six cases, these changes may be summarily stated as follow; and, apparently, in the following order of succession.

No morbid deposit nor any appreciable alteration of structure takes place in the walls of the blood-vessels of the cord; but the arteries are frequently dilated at short intervals, and, surrounded, sometimes to a depth of double their diameter, by granular and other exudations; beyond and amongst which, the nerve-tissue, to a greater or less extent has undergone certain changes. In the first stage, softening of this

\* Constitutional Irritation. A further Inquiry, 1835. Travers, p. 315.

† System of Surgery. Ed. by T. Holmes.

‡ On the Pathology of Tetanus, 1865: Med.-Chir.-Trans. Lond.

tissue; secondarily, granular disintegration, the tissue becoming softer or semifluid, and more transparent. Ultimately, the reduction of the tissue to a fluid state. This fluid at first, is more or less granular, holding in suspension the fragments and particles of the disintegrated substances, but in many places, it is perfectly pellucid. The blood-vessels also share in the disintegration of the part, and commingle with their ensheathing granular exudation. Thus a general softening and disintegration of structure has taken place. A fluid area, of considerable size, may occur at a single spot, and extend to the surrounding tissue; or at several spots, which advancing, coalesce between irregular masses of the tissue, or portions separating, are left as islets in the fluid.

This process of destruction affects the grey substance of the cord; perhaps its central part.

The same lesions of the cord are found in paralysis. But they are commonly unaccompanied by *spasm*, during life. Tetanus therefore probably differs only from that disease in being associated with a morbid condition or injury of some of the peripheral nerves. A marked congestion and inflammation of a nerve connected with, and leading from, a wound that has occasioned the disease, is a local morbid condition, which Mr. Erichsen states he has never found wanting; the vascularity, which may be very intense, often extending up the neurilemma to a considerable distance.

It would therefore appear—observes Mr. Lockhart Clarke—that this condition or injury of the peripheral nerves is the determining cause of the phenomena, and that the spasms of tetanus depend on the conjoint operation of two separate causes.

First, on an abnormally excitable state of the *grey nerve-tissue of the cord*, induced by the hyperæmic and morbid state of its blood-vessels, with the exudations and disintegrations resulting therefrom. This state of the cord may be either an extension of a similar state along the injured nerves from the periphery, or may result from reflex action on its blood-vessels excited by those nerves. Secondly, the spasms depend on the persistent irritation of the *peripheral nerves*, by which the exalted excitability of the cord is aroused; and thus the cause which at first induced in the cord its morbid susceptibility to reflex action is the same which is subsequently the source of that irritation by which the reflex action is excited.

In so-called *idiopathic* tetanus, arising from exposure to cold and damp, it is probable that the morbid condition of the blood-vessels of the cord, results from changes in the state of the peripheral nerves, which may act through reflex action or otherwise.

Associated with these essential changes of structural condition in tetanus, others which are apparently incidental, may be noticed. A marked vascularity of the membranes of the cord and engorgement of the veins within the vertebral canal. In a case of strangulated femoral hernia, for which I operated, all went on favourably for a week, and the incision had nearly healed; when suddenly the most violent tetanus set in, beginning with locked-jaw, proceeding to appalling opisthotonos, and terminating fatally on the fourth day, by which time the wound had reopened and become gangrenous. I carefully examined the cerebro-spinal axis throughout its whole extent. The intra-spinal veins were gorged with blood, but not those of the cord itself. The intestines have been found much inflamed in several cases; and in two, a yellow, waxy fluid,



of a peculiar offensive odour, covered their internal surface.\* The pharynx and œsophagus may be much contracted, and contain a viscid reddish mucus.† The muscles are usually rigid; sometimes ruptured, and sometimes there is no rigidity.

*Causes.*—*Injuries* of all kinds may possibly be followed by tetanus. From the most trifling scratch to the most terrible laceration, tetanus may ensue, yet not with equal probability. But it occurs most frequently from those injuries which in point of their *extent* or *persistence*, by continued nervous irritation, are most conducive to the continuance of Shock. I have already noticed that variety of “prostration with excitement,” in which the excitement is tetanic. Burns are thus peculiarly liable to induce tetanus. Punctured, lacerated, and contused wounds, particularly of the hand or thumb, of the sole of the foot or of the toes, have a direct tetanic tendency. Unyielding fibrous textures are peculiarly revengeful in this respect. Compound fractures and dislocations, rather than the simple form of these lesions, are threatening complications; and more so, if the fracture be oblique and playful among nerves and muscles, or if the dislocation be that of a ginglymoid joint, as the thumb. Gunshot wounds, involving possibly other forms of injury, rank high as causes. Amputation, as in the thigh, or the removal of a breast or testicle, are known causes. So also minor operations; *e.g.*, for fistula in ano, ligature of piles, extraction of a tooth, cupping, the irritation of a seton. *Diseases*; *e.g.*, gangrene, ulcer of the leg, a guinea worm under the integument, caries of the tibia. In obstetric practice; abortion, retained placenta.

The *condition* of a wound, at the time of tetanus, seems to have little relation to the disease. Thus, in one case, recorded by Hennen, cicatrization was completed on the same day that life terminated; and Dr. Elliotson observes, that the disease has sometimes declined and ceased, although the wound daily grew worse.

*Period of probation* or incubation, between the local injury and the commencement of tetanus. This period has its *average* limits of duration. As extremes may be mentioned a few hours, or some days,—the fifth to the fifteenth day, and up to the twenty-second day; the average being the tenth day.

Tetanus arising from any of the foregoing forms of Injury, is denominated *traumatic*; as distinguished from tetanus arising from other causes, whether external or internal, unconnected with Injury, the disease being then named *idiopathic*. But this distinction relates to origin only, and is, moreover, not always definite. Such causes include, exposure to cold and damp, currents of air hot or cold, bad ventilation or atmospheric poisons, irritation of worms, sudden suppression of the perspiration, of the catamenial or lochial discharges, or of acute diseases, and terror or anxiety of mind.

*Predisposing causes.*—The disproportion, in many cases, between the local injury and the development of tetanus, as well as the varying period of probation intervening; are probably due to the influence of predisposition. A scratch of the thumb by a broken plate, proved fatal in a quarter of an hour; and in other cases, a slight blow, as by a whip-lash under the eye, although the skin was unbroken, has been followed by tetanus. In such cases, some predisposing condition probably was

\* Med.-Chir.-Trans., vol. vii. p. 475.

† Mém. de Chir. Militaire. Larrey, t. iii. p. 287.



also in operation. *Age*.—No period of life is exempt; but, perhaps, infancy and middle age are most subject. In infants, the disease—then named *trismus nascentium*—occurs from seven to fourteen days after birth. It may terminate fatally in ten or thirty hours, or life be prolonged to eight or nine days. Its origin is apparently traumatic; namely, from division of the umbilical cord, or irritation of the intestines by meconium, or worms; or it has been traced to unwholesome food, bad ventilation, or exposure to currents of air. It occurs very frequently in the Tropics, occasionally in Europe. *Sex*.—Males are most liable to tetanus, in a ratio of about seven to one female. *Habits of life* seem to have little influence, the disease attacking equally the temperate and the intemperate. *Constitutional susceptibility* is not apparent; individuals of any temperament being equally liable. *Climate*.—The disease is more prevalent in warm climates and in marshy districts; also near the sea-coast than inland. Nevertheless, *season of the year* is said to have no influence on the occurrence, or the mortality, of tetanus.\*

*Course, and Terminations*.—(1) Generally, tetanus proceeds in a continuous course of development; affecting the muscular system, in the order already mentioned, and terminates *fatally*. About the second or third day, as *acute* tetanus; the ninth or tenth day, as *chronic* tetanus. But the former is commonly fatal, the latter far less so. The *mode of death*, is, commonly, during a *paroxysm* affecting chiefly the muscles of the larynx; which, by complete closure of the glottis, produce almost instant suffocation. The slightest attempt to move, or to swallow, seems to excite this issue. I witnessed it in one case, during the attempt to swallow an opiate pill. A sudden jerk of the throat occurred, a suffusion of the face, succeeded by deadly pallor, and all was over. *Exhaustion*, is another, but less frequent mode of death.

(2) *Recovery* is preceded by a gradual subsidence of the tetanic contractions; and this happy issue is generally granted to the few who survive the tenth day. It is also stated, that the longer the period of *probation*, before the commencement of tetanus, the greater is the probability of recovery. Conversely, the shorter the period of probation, as well as the more rapid the progress of the disease, the more surely fatal is the issue. But this, perhaps, general rule, is exceptional in many cases of rapid progress, after the probationary period of ten days.

*Prognosis*.—The prognosis of tetanus will be guided by a due consideration of the conditions which chiefly determine its tendency to a fatal issue, or to recovery. They are, principally, the traumatic or idiopathic origin of the disease, the influence of predisposition, as evinced by its speedy accession, and its acute or chronic progress.

*Treatment*.—*Preventive measures* are the most, or only, effectual resources. This implies the early detection and removal of any persistent causes in operation; such intervention necessarily having reference to local causes, rather than to constitutional causes, which mostly elude detection or are beyond control. Hence prevention is practicable mostly in tetanus of *traumatic* origin. Happily, also, the intervening period of probation is available for surgical interference. Wounds may be thoroughly cleansed of foreign bodies, and the parts adjusted. Swelling, under tight, unyielding textures, may be relieved by incisions. Burnt surfaces may be effectually protected from the influence of the air. Most compound

\* Guy's Hospital Reports, vol. iii. ser. iii.

fractures and dislocations can be soon detected, reduced and kept in position.

Are there any other causes possibly in operation besides the local injury? Constipation is constant and significant; significant, partly because constant, and also because of the peculiar matter voided when an evacuation does occur. More than forty years since, Abernethy proposed for the consideration of surgeons this question—whether the disordered condition of the digestive organs, established during the irritative state of the wound, may not be the occasion of tetanus, when that irritation has itself ceased? If, he adds, this proposition be established the very important conclusion follows, that by preventing the disordered condition of the digestive organs, you would prevent tetanus. No purgative medicines that I know of for this purpose are specially serviceable.

The foregoing preventive considerations are most important; for every practical surgeon will concur in acknowledging the hopelessness of all known medicinal treatment when the disease is fully developed; and, in such case, the equal inutility of any surgical operation to relieve the symptoms of, much more to cure, this deadly disease.

*Remedies*, then, there are none, at present known. The long list of medicinal and surgical resources which have been successively tried, and have failed, Mr. Poland thus enumerates. Antiphlogistics, including blood-letting, purgatives, calomel, antimony, colchicum, &c., have been extensively used; alteratives, as the various preparations of mercury, large doses of fixed alkalies, solutions of arsenic, &c.; diuretics, in the form of tincture of cantharides, oil or spirits of turpentine, given in frequent and large doses, so as to irritate the urinary passages, or to occasion bloody urine; sedatives, such as digitalis, tobacco, nicotina, hydrocyanic acid, aconitina; anodynes and narcotics, as opium, morphia, belladonna, cannabis indica, ether and chloroform internally and by inhalation; stimulants and antispasmodics, including musk, ammoniacum, camphor, turpentine, assafœtida, castor, wine and other stimulants; tonics, such as quinine, bark, strychnia, iron, zinc, &c.; hygienics and dietetics, as support, milk-diet, &c.; injections into the veins of solutions of opium, stramonium, &c.; tracheotomy and laryngotomy.

This list of variously accredited remedies, is at least suggestive of what to avoid, as useless, or perchance, noxious, in the course of tetanus. Chloroform may relax the spasms, for a while, and thus relieve pain. It had this temporarily palliative influence in the overwhelming case, after strangulated femoral hernia, which I had reduced by operation.

# PART II.

## SPECIAL PATHOLOGY AND SURGERY.

---

### DIVISION I.

#### INJURIES AND DISEASES OF TEXTURES.

---

#### SKIN AND SUBJACENT TEXTURES.

---

#### CHAPTER XIV.

WOUNDS:—INCISED WOUND. WOUNDS OF ARTERIES AND VEINS.

A WOUND is a solution or breach of continuity of the soft tissues, suddenly produced, in any part of the body. Such lesion may be effected by various instruments of a cutting, tearing, or puncturing, character. Hence, Wounds are commonly distinguished, as Incised, Contused and Lacerated, and Punctured. Gun-shot Wounds are also contused and lacerated. Poisoned wound is characterized, not by the nature, and still less by the extent, of the lesion itself, which may be only a slight puncture; but, by the accompanying introduction of some poisonous matter, whereby the constitutional disturbance becomes of far greater consequence than the local lesion. Such are stings of bees, wasps, hornets; snake-bites; bites of rabid animals, giving rise to hydrophobia; and dissection wounds.

Excluding, therefore, poisoned wounds; Wounds differ most significantly in their relation to the laws of Reparation. *Incised* wound has a natural *tendency* to undergo repair, or to heal, by primary adhesion, when its surfaces are placed in contact; all other wounds, in proportion as they are *contused* or *lacerated*, have a natural *tendency* to sloughing, and then to undergo repair by the slower process, on an open surface, of suppurative granulation and cicatrization.

#### INCISED WOUND.

An Incised Wound is a solution of continuity of the soft textures; suddenly produced, and with even division of the tissues. The former character distinguishes this lesion from a breach resulting from ulceration; the latter character defines it from a contused wound.

*Symptoms.*—Pain, and hæmorrhage or effusion of blood, in various degrees, accompany the division of nerves and blood-vessels; and the wound opens or gapes more or less, according to the elasticity, muscular contractility, and weight of the parts. The former symptoms are not peculiar to this, or any other kind of Injury,—thus illustrating the insufficiency of

Functional Symptoms in Diagnosis [P. p. 169]; while absence of the latter symptom—gaping of the wound—is the negative distinction of a *subcutaneous* incised wound. But this lesion is, moreover, not exposed to the action of the air; a peculiarity of essential importance—as determining the course of a subcutaneous wound in respect to its more speedy reparation.

*Cause, and Effects of Incised Wound.*—Incised wound is produced by the edge of any sharp cutting instrument, as a knife; not by a blunt or a pointed weapon.

Its effects are essentially local, in relation to the function of the part wounded; but the lesion produces constitutional disturbance in proportion to the implication of nerves and blood-vessels, and to the functional importance of the part in the system. Hence, the *Shock* of injury to the nervous system; the *Collapse* arising from profuse or persistent hæmorrhage; and the serious *functional disturbance* arising from wound of an internal organ, as the lung or intestine.

*Reparation.*—Incised wound tends to undergo the reparative process of healing by primary adhesion, unaccompanied by inflammation; when the surfaces of the wound are in contact. But an incised wound may heal by other modes of reparation, under different circumstances. It will therefore be necessary to here describe all these modes of healing, which are four in number; although the latter two will be found to pertain more especially to Contused and Lacerated, or open, Wounds. The inherent power of organization which the *materials* for reparation, possess, must first be noticed; and in virtue of which all other kinds of Injury undergo repair.

*Reparative Materials.*—*Coagulable lymph*, and, possibly, *blood* are the materials supplied; and their reparative power is exhibited by the organization they both undergo, spontaneously. John Hunter, so far as I know, first advocated the possibility of blood undergoing this change; and it was with him the mode of “union by the first intention.”\* Subsequently, the organizability of blood was disputed by Mr. Travers† and other observers. Now, however, it is amply confirmed by the microscopic observations of Zwicky,‡ Paget,§ and Dr. W. T. Gairdner,|| not to mention others. I allude to observations such as these:—the organization of blood effused in serous sacs, particularly in the arachnoid; of clots in veins being converted into fibrous cords, or having evinced less constructive power, degenerating into phleboliths; clots forming distinct tumours in the heart and arteries; and the clot above a ligature on an artery becoming part of the fibrous cord which constitutes the impervious portion of artery.

Mr. Paget thus estimates the function of blood in the repair of injuries:—1. It is neither necessary nor advantageous to any mode of healing. 2. A large clot, at all exposed to the air, irritates and is ejected. 3. In more favourable conditions, the effused blood becomes enclosed in the accumulating reparative material; and while this is organizing, the blood is absorbed. Lastly, it is probable that the blood may be organized and form part of the reparative material; but even in this case it probably retards the healing of the injury.

\* Blood. Inflammation and Gun-shot Wounds, p. 193-4.

† Physiology of Inflammation, and the Healing Process, 1844, p. 162.

‡ Die Metamorphose des Thrombus, 1845.

§ Surgical Pathology, vol. i. 1853, p. 174.

|| Edinburgh Monthly Journal, Oct. 1851, p. 392.



Mr. Paget then traces the process of organization which coagulable lymph undergoes. Fibro-cellular or connective tissue is formed, but in either of two different ways, or by both processes of development simultaneously; and the particular mode of lymph-development is determined chiefly by the circumstance of exposure or not to the air. Lymph effused for the repair of open wounds generally develops itself into fibro-cellular tissue, through nucleated cells, which elongate into filaments; while that effused for the repair of subcutaneous wounds as generally develops itself into this tissue, through the medium of nucleated blastema—by the nuclei developing themselves into fibres (Henle), or by the blastema itself undergoing fibrous transformation (Paget). The same state of organization—fibrous tissue—is thus attained, by either of these different processes of self-development, or, as I have said, by the association of both in some, probably many, instances of reparation.

*Modes of Reparation.*—Wounds may heal in one or other of four different ways, first clearly distinguished by Macartney; and subject to certain modifications, the distinctions he drew are still accurate.

First. Immediate union, without any intervening substance, such as blood or lymph. (Union by the first intention, and through the medium of blood—Hunter.)

Secondly. Union by the medium of coagulable lymph, or a clot of blood—mediate by lymph or blood. (Union by adhesion, or adhesive inflammation—Hunter. Union by first intention, as now commonly understood. Primary adhesion—Paget.)

Thirdly. Reparation by suppurative granulations.

Fourthly. Healing under a scab. (The modelling process of Macartney?)

Each of these processes of healing claims some further notice, and in reference to the power of reparation indicated thereby.

(1) *Immediate union* is effected only under certain circumstances. Incised wounds will thus unite when the cut surfaces are immediately replaced in close contact, so that no substance of any kind intervenes. The blood itself is pressed out of the wound, the divided blood-vessels and nerves are brought into perfect contact, and reunion ensues by the opposed surfaces simply growing together. This process of repair is very speedy. It will take place in two or three days; possibly in almost as few hours. No intermediate substance exists in a wound thus healed; consequently no cicatrix or mark remains. Nature undertakes and may accomplish the immediate union of any incised wound, irrespective of its extent, provided only the conditions mentioned are fulfilled. Thus, divided nerves may reunite, as manifested by the recovery of sensation or other function peculiar to them. But restoration is, generally, very slowly effected. In a case under my care at the Hospital, the tongue was severed by an incised wound, extending nearly through the substance of that organ, which hung by a mere shred on the left side; dividing the gustatory and hypoglossal nerves on both sides. The divided portion having been promptly replaced and secured, in even contact with the root, complete reunion took place;—the tongue slowly recovering the power of motion and the sense of taste.

(2) *Primary Adhesion.*—A period of reparative inactivity, perhaps of short duration, succeeds the injury; during which the divided textures are indisposed to unite, although placed in apposition. But this condition of apparent inactivity may partly be due to interception of the

process of reparation; either by the presence of some foreign body between the cut surfaces, or from continued hæmorrhage. The process begins whenever the textures are *glazed* over, thus sealing the blood-vessels. This appearance of the wound denotes either the previous exudation of reparative lymph, or the coagulation of a thin layer of blood, just sufficient for adhesion. Reparation then commences. Either form of reparative material—lymph or blood in small quantity—undergoes organization, apparently by virtue of its own inherent formative power.

*Fibro-cellular tissue* thus produced, consists of cells lengthened and attenuated into fibres. (See Fig. 2.) This constitutes an intervening layer of texture as the permanent bond of union, thence named connective tissue, and which presents externally the appearance of a linear cicatrix, or scar. Fibres of this kind must not be confounded with the very fine filaments seen in *coagulated lymph*, and which are produced apparently by the linear coalescence of molecules. (See Fig. 1.) The one are cell-fibres, and arranged when finished as fibro-cellular tissue, in fibres having cellular interspaces; the other are molecular fibres, and interwoven like felt in various directions, as seen in the clot of buffed and sized blood, or in coagulated lymph exudation on the surface of a serous membrane. (See Fig. 1.) These fibres are, however, accompanied with numerous cells, each containing three to eight granules; and similar cells are found in reparative lymph, in which they abound. Hence named *plastic cells* by Dr. Hughes Bennett, they are the *pyoid* cells of Lebert, so named from their general resemblance to pus corpuscles. But, unlike them, neither water nor acetic acid much affect plastic cells. New capillary blood-vessels shoot through the connective tissue; they are formed also in coagulated lymph, and occasionally in blood-clot, as reparative materials. These vessels are produced by a highly interesting process of development, as described with that of Healing by Suppurative Granulation, in Contused and Lacerated Wounds. Eventually, the new tissue is fashioned off, so as outwardly to resemble the particular texture in the substance of which it is interposed; but this resemblance scarcely extends to their minute structure. Reproduction of the original texture is, in fact, a rare event. Skin, with its papillæ and cuticle, muscle, tendon, artery, cartilage, and bone, in the first stage of fracture-union are severally represented by fibro-cellular tissue, more or less vascular; nerve is said to be repaired in like manner, and also by the formation of new nerve fibres, which running through the connective tissue, become continuous with those in the nerve above and below, thus reinstating its continuity. The grey matter of nerve centres would not appear to be reproducible.

This mode of union is less desirable than the immediate; the formation of lymph or exudation cells being a process so indefinitely separated from that of pus-cells, that union thereby is much more likely to pass into suppuration than any process in which no lymph is formed; then again, it is probably not so speedy in most cases; and finally, if accomplished, it is not so close, a scar therefore always remaining by the organization of the new intervening substance.

(3) *Suppurative granulation* and *cicatrization* is that process by which all other than incised wounds are commonly healed. It will be described most advantageously in connexion with Contused and Lacerated Wounds.

(4) *Healing under a scab* ranks higher, in respect of its result, than that by suppurative granulation. Open wounds, and superficial burns,

may heal in either way. The cicatrix formed under a scab more nearly resembles the natural textures, and being also less contractile, is less disfiguring. Yet the process of healing in this way is more liable to miscarry. Inflammation is apt to supervene, and discharge accumulating under the scab, the healing process is again and again delayed, or recommenced. No such impediment interrupts the progress of suppurative granulation, or the course of an *open* sore.

The scab itself is formed of dried blood, lymph, or pus; but the precise nature of the reparative process underneath is concealed from our view. So far—observes Mr. Paget—as one can discern with the naked eye, the wounded surface forms only a thin layer of cuticle on itself; no granulations, no new fibro-cellular tissue, appear to be formed; the raw surface merely skins over, and it seems to do so uniformly, not by the progressive formation of cuticle from the circumference towards the centre, as is usual in open wounds.

Healing by the “modelling process” is somewhat similar. It takes place under a scab or protective film. But that “natural growth” of textures proper to the part, by which it was said to be re-made or remodelled, and which was thought to be the special and characteristic feature of the modelling process, is probably only the growth of granulations, *without* suppuration, because not exposed to the air.

This mode of healing, like the last, is often witnessed in the wounds of animals. Macartney first described its characters, and I state them on his authority.

“The pain arising from the injury soon ceases. No tumefaction ensues, separating the edges of the wound; and its surfaces are not only disposed to lie in contact, but even to approach each other so much, that they cannot be kept asunder by mechanic restraint; there is therefore no necessity for the effusion of lymph; and as there is no cavity to be filled up, granulations are not formed. The surfaces of the wound, although they come into contact, do not unite by vessels shooting across; they are smooth, red, and moistened with a fluid, which is probably serum, and present the appearance of one of the natural mucous surfaces of the body. If any parts have been killed by the injury, they are detached by simply as much interstitial absorption as may be sufficient to set them free. The wound is finally healed by the same means which determine the shape of the natural parts of the body. It gradually diminishes in extent until obliterated; or it may be cicatrized before the surfaces are abolished, after which the same process of natural growth goes on until no part of the original wound remains. The cicatrix which succeeds the cure of injury by this modelling, or growing process, is small, pliant, free from callous adhesions to the parts underneath, and morbid sensations, that so often belong to cicatrices, which have for their bases deposits of lymph, or the new-formed structures, called granulation.

“When the modelling process, or cure by natural growth, goes on perfectly, there is no inflammation in the part, and the patients are so entirely free from all uneasy sensations, that I have known instances of their being ignorant of the real site and extent of the injury until they had examined the part with their hand, or seen it in a looking-glass.

“It might be anticipated, that as this mode of reparation bears so strong a resemblance to the natural formation and development of parts, it is the slowest mode; but this is of little account when compared with



its great advantage in being unattended with pain, inflammation, and constitutional sympathy, and leaving behind it the best description of cicatrix. It constitutes the nearest approach, in the higher classes of animals, to the regenerative power exhibited by some of the inferior tribes.”\*

The *Prognosis* of incised wound—as an adhering wound—is most favourable. But the breach of continuity may be maintained by various circumstances which prevent or impede coaptation of the parts. The *weight* and *mobility* of loose and pendulous parts, tend to prevent union, or to disunite them in the process of healing by primary adhesion. *Muscular action*, tending to displacement, will have the same effect, and to a greater degree, if co-operative. A deep and extensive flesh-wound, say of the thigh, illustrates this concurrence of causes. Any *foreign body*—e.g., grit, or clot of blood—intervening between the surfaces, otherwise in apposition, will prevent complete union, and tend to induce suppuration with an open wound.

These various conditions illustrate the Prognostic guidance of Persistent Causes. [P. p. 701.] But the surfaces of an incised wound are usually clean.

*Treatment*.—To be effectual, in regard to this or any other lesion, surgical appliances must meet the requirements of the natural process of reparation, throughout its course; of which the treatment will then be a continued reflection.

The Indications are three :—(1) Arrest of hæmorrhage; (2) removal of foreign bodies; (3) coaptation of the opposed surfaces.

*Hæmorrhage*.—Small vessels soon spontaneously cease to bleed; their cut extremities retracting and contracting. Larger-sized arteries bleed *per saltum*, in jetting streams of florid red blood. Venous hæmorrhage is distinguished by the even flow of purple or black blood. The treatment of hæmorrhage will be described in connexion with Wounds of Arteries and Veins. But the arrest of hæmorrhage, spontaneously, will be aided by exposure of the wound to cool air, or a stream of cold water squeezed from a sponge. Gentle pressure with the sponge on the cut surfaces will readily discover whether there be still any oozing from the bleeding points.

Obviously, any *foreign body*, if present, should be at once removed. Not roughly, however. The same application of water, as for hæmorrhage, will generally suffice to dislodge and carry away grit, &c., or the particles may be lightly brushed off with the wet sponge.

*Coaptation*.—The coaptation of an incised wound might be postponed, until the wound has become glazed and adhesive. Then reparative material begins to exude. This indication as to *time* was always observed by Mr. Liston, with regard to the amputation-wound of a limb, and all other *large* wounds. The deeper and more extensive the wound, the more advisable is it to wait this event; with one exception,—a deep muscular wound, which retracting and gaping, non-interference would allow the muscles to become agglutinated within their sheathing fasciæ. But the *general* rule—applicable alike to small cuts, or to extensive and deep incisions, accidental or surgical, is this;—hæmorrhage having ceased or been arrested, and any foreign body, accidentally present, having been removed; the wound is now prepared to undergo the process of reparation.

\* Inflammation, pp. 53-4.



(1) *Coaptation* signifies the adjustment of the apposed surfaces in even contact. This, however, implies a suitable position of the part, to relax any muscular action or tension.

(2) *Retentive Appliances.—Dressing.*—The maintenance of coaptation during the process of adhesion, also implies the same attention to position; and some kind of retentive appliance; both being necessary to insure rest. In the selection of any such appliance; the plastic nature of the healing process would indicate, that the less retentive it is, the better; provided only it be sufficient to maintain easy apposition. The surgeon should always consider his mechanical dressings in this light; that he may the more exactly reduce them to co-operative conformity with the course of reparation. And by clearly understanding the proper management of a typical form of Injury, which occurs so frequently in Surgical Practice, as does an incised wound, and which represents nine-tenths of surgical operations; he will be enabled to take a commanding view of his art.

The appliances in question are designed to maintain the apposition of, either the *lips*, or the *surfaces*, of the wound. Plaster, sutures, or both, fulfil the one intention; a bandage, with or without light compresses, accomplish the other purpose.

The *plaster*, commonly used, is the adhesive—diachylon—plaster. Isinglass plaster, introduced by Mr. Liston, is, however, preferable. It is equally adhesive, quite unirritating, and transparent, so that the progress of healing can be watched from day to day. If common adhesive plaster be used, the remark of Professor Gross is of some practical importance. It should be cut in the direction of its length, the texture in breadth being more yielding; so that if cut in that direction, the plaster is apt to become loosened when heated by the skin. Any blood or dirt around the wound having been washed off, the surface is lightly wiped dry with a clean soft cloth. Blood remaining, it stiffens, tightens and irritates; nor can it be removed subsequently without an unwarrantable degree of handling and rubbing. Thus also, any hair on the part, is better cut off in the first instance. Strips of plaster, of length and breadth suitable to the size of the wound, are then applied; and most advantageously, by placing the first strip over the *centre*, and another on either side alternately, leaving intervals between them wherever the edges of the wound lie in even and easy apposition. Any oozing is thus allowed to escape, the more so from a deep wound.

*Sutures* are made of silk-twist; or metallic wire, of various kinds; gold, silver, iron, or lead. They are apt to induce inflammation and ulceration of the skin around each, as a centre. Silver-wire is, perhaps, less irritating than silk, which acts as a seton. A number of such sutures are, in effect, so many little setons, along the margin of a wound. The apparently greater tolerance of silver sutures, is witnessed after the operation of joint-excisions. Fine telegraph wire has been introduced into surgical practice by Mr. Clover. It consists of a fine copper-thread, coated with gutta-percha. This is soft, flexible, tough, and perfectly unirritating; it admits, therefore, of ready introduction and knotting as a suture, and it may be left in the tissues for ten or fourteen days, without inducing any suppuration or inflammation along its track. Sutures, of some kind, are necessary alone, or as adjuncts to strips of plaster, whenever the wounded part is liable to be disturbed; whether by muscular action, its own weight, or looseness. Such parts are the lips, tongue, soft palate, cheeks, nose, eyelids, ears; breasts, abdominal walls,

bowels, scrotum, and the integuments around joints. When used, sutures are applied *before* the retentive strips of plaster; and only to bring the margins of the wound together, here and there, forming the "interrupted" suture. (Fig. 31.) Commencing in the *centre* of the wound, in order to judge of the even adjustment of the rest of its extent, the first suture is inserted by means of a curved needle, armed with silk or wire. Then another is placed alternately on either side, and so on, from point to point; but only where necessary to secure apposition.

FIG. 31.

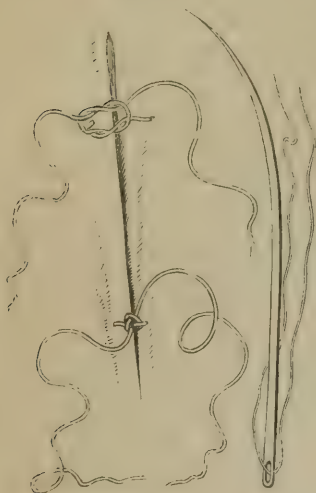
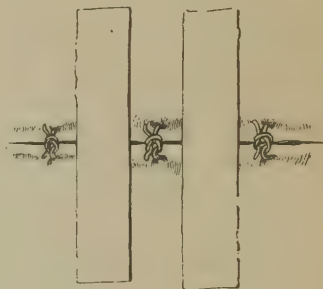


FIG. 32.

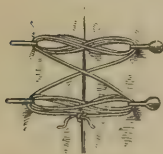


If silk be used, each suture is tied with a reef-knot; if wire-suture be used, a twist or two will secure it. In either case the ends are then snipped off short. As few sutures only, as may be requisite, should be inserted; for, besides their irritating character, coaptation can be efficiently maintained in the intervals between them by strips of plaster. (Fig. 32.)

Other forms of suture are employed in special kinds of incised wounds.

The "twisted" suture is a waxed thread, twisted or coiled into a figure of 8 shape around a fine needle, previously transfixed through the lips of a wound in apposition. (Fig. 33.) It is most serviceable for wounds of the lips, as in the operation for hare-lip, and for wounds of the abdominal walls.

FIG. 33.



The "quilled" suture consists of a number of interrupted sutures, secured, not across the lips of the wound, but, on either side, to a quill, piece of bougie

FIG. 34.



or other small cylinder, placed parallel about half an inch from the margins of the wound. (Fig. 34.) Textures below the surface are thus approximated and steadily held together; an advantage in respect to a deep wound, as well as in any moveable part. Ruptured perinæum is thus secured. The "uninterrupted" suture, or Glover's stitch, is seldom used, excepting for wounds of the intestine, which are

stitched close so as, if possible, to prevent the escape of fecal matter. The "button" suture of Bozeman, the "clamp," and the "serrefine," of M. Vidal, may be here mentioned.

A *bandage* or roller, and *compresses* or light pads of lint, may be required to maintain the *surfaces* of a wound in contact. This, more especially, if the parts are muscular and liable to retraction, or bulky and apt to fall asunder. Deep or excavated wounds, therefore, mostly need this *extra* restraint or support. But it should be applied evenly, and only with sufficient pressure to invite adhesion, by preventing displacement and any oozing hæmorrhage. Amputation-wounds well illustrate the circumstances alluded to. Muscular retraction and weight of the flaps, thence recurring displacement and oozing hæmorrhage, are overcome and obviated, by the additional retention of compresses and a bandage applied with even and moderate pressure.

The line of incision, visible between the strips of plaster, needs only the protection of a piece of wet lint, as "water-dressing," covered with oil-silk to retard evaporation; and which may be occasionally moistened without removing it or otherwise disturbing the healing process. *Collodion* is sometimes used for the purpose of temporarily sealing the lips of an incised wound. Applied with a camel's-hair brush; it should be used quickly, and in such quantity that one application of the brush may suffice; for collodion is very adhesive, dries almost immediately, and contracts.

*Antiseptic-Dressings.*—Disinfection and Deodorization have, of late years, attracted much attention, more particularly in this country; and especially in the treatment or dressing of Wounds, whether occasioned by accident or by surgical operation. These terms, disinfection and deodorization, are not at all necessarily synonymous. Disinfection represents the neutralization or destruction of the infectious property, whatever that may be, in the atmosphere, or in any liquid, or solid substance, as an article of clothing—whereby a disease, itself infectious, is communicated and propagated; Deodorization signifies only the neutralization of an odoriferous property, and possibly, simply by masking it by some more powerful and penetrating odour. Probably, disinfection is far more frequently attended with deodorization, than the latter implies the former. Thus, solutions of carbolic acid, chlorine, and chloride of zinc, are Disinfectants; whereas, the aroma wafted from burning spices, or the fragrant spices of the East, employed in times gone by, would sweeten rather than purify the sick chamber; like the camphor-bag in domestic use, or the time-honoured rue strewed about the dock of our criminal courts—all such agents more often delude the sense only—they are Deodorizers. In relation to Infectious Fevers—diseases which equally concern the Surgeon and Physician, the prevention of Infection and its propagation, is fully considered in my other work. [P. Ch. viii.]

Disinfection in relation to the treatment of Wounds—accidental or surgical, may be termed Antiseptic; the object being to prevent the putrefaction of any blood or liquor sanguinis extravasated, or of pus formed subsequently—and it would seem to also control the formation of the latter fluid. Thence, primary union of the wound is induced, and the liability to purulent infection of the blood—Pyæmia, or by decomposing animal matter, septic matter, producing Septæmia, is prevented; the further liability of any propagation of infection being necessarily



excluded, as the wound remains healthy, and heals with little or no supuration.

The *principle* of antiseptic-treatment is twofold :—

Firstly. By the exclusion of air, as the infecting agent, from the wound.

Secondly. By the interposition of some positively disinfecting, or antiseptic dressing, in the form of a close covering to the wound. Professor Lister of Edinburgh—who has mainly originated antiseptic-treatment—enlarges this aspect of the principle, thus;—"an antiseptic to exclude putrefaction, with a protective to exclude the antiseptic, will by their joint action keep the wound free from abnormal stimulus."\*

This principle may be *fulfilled* as follows :—

(1) Exclusion of air from a wound may be effected by simple water-dressing, as already described; care being taken to apply the dressing so as to form a close covering, and which is enveloped in oiled-silk. Or, the air may be withdrawn by an exhausting receiver, as has been tried in France.

(2) Antiseptic-dressings of various kinds have been used; and as a process of treatment, comprising many details, apparently essential to its success as a specific method, this has been named by Professor Lister, the "Antiseptic system of Treatment."

(a) The "protective" should possess several properties; it should be a material impervious to carbolic acid, and unstimulating in its own substance; at the same time, it must be insoluble in discharges, and sufficiently supple to apply itself readily to the part. Various materials have been tried and discarded; as a metallic plate, itself impervious, but when made of block tin, it was too rigid, and tin-foil soon wears into holes. Gutta-percha soon transmits carbolic acid. The "protective" Lister now uses, is oiled silk; prepared by having a thin coating, brushed over it, of a mixture consisting of one part of dextrine, two parts of powdered starch, and sixteen parts of cold watery solution of carbolic acid—1 to 20.

(b) Antiseptic "lac-plaster" is laid evenly over the protective and extending freely beyond the wound; and over both, the part is enveloped with a cloth, to absorb any discharge which may ooze from beneath the margin of the impermeable plaster, the cloth being secured in position by a roller-bandage. The plaster now used is incorporated with a soft cloth, instead of being spread upon starched calico.† It is thus made more flexible and durable, but very thin; so that a double layer may be advisable, to double the store of acid in the application, when much discharge is anticipated, or when the dressing is not to be removed for some time. "The carbolic oil," and "carbolic paste or putty," formerly used and advocated by Mr. Lister, he now seems to have almost abandoned. Recently, however, to complete the antiseptic appliances which may be requisite in the treatment of wounds; he has devised "antiseptic ligatures" of prepared catgut, for securing blood-vessels, and "antiseptic sutures," for retaining the lips and surfaces of a wound in contact.

Previously, to applying the solid antiseptic dressing, above described, the wound is well syringed out with "carbolic solution or lotion," as strong as it can be made,—one part of the crystals to twenty of water. The

\* A Case of Compound Dislocation, &c., illustrating the Antiseptic System of Treatment. 1870.

† This plaster, in its best form, may be obtained from the Old Apothecaries' Company, Virginia Square, Glasgow.



transient irritant property of this strong solution, is said to be far less objectionable than the abiding influence of the more acrid products of putrefaction; even although the solution be thrown into the interior of a large joint, as in the dressing of a compound dislocation of the ankle-joint. A weaker lotion, one to forty, will suffice, in dressing a recent, and surgical, wound. The *skin* around a wound is well washed with the lotion. Then, the protective, lac-plaster, outer cloth and bandage, are severally applied.

*Reapplication* of the dressing may be required, or advisable, occasionally; in the intervals, the bandage and cloth may be daily moistened with carbolic solution, strong or weak,—one to eighty, to renew a supply of the antiseptic to the lac beneath. Great care must be taken in removing the antiseptic dressing, not to admit air into the wound, or any regurgitation of discharge. Hence two precautions; in removing the cloth, the plaster should be held down over the wound, so as not to be drawn up with it, at any part where they may have become adherent by dried discharge; then, in raising the plaster, the nozzle of a syringe is inserted beneath its margin, and a stream of carbolic solution is thrown over the wound, until a piece of calico soaked with the same lotion, has been placed upon it, as a temporary security, pending the reapplication of the plaster. “These details, while essential to success, are, happily, easy of execution.”

*Theory of the Antiseptic Treatment.*—To form an impartial judgment respecting the efficacy of “antiseptics,” it is necessary, as in all other aspects of surgery, to draw a sharp line of distinction between observed facts, and their supposed explanation or interpretation. The non-recognition of this obviously important distinction has influenced both favourably and unfavourably, the practice of antisepticism. To prevent, if possible, the putrefaction of animal matter, whether as blood or discharge, in contact with wounds, is known to be most important, pathologically, as an observed fact; and that carbolic acid has some such influence, is another observed fact. But, how it operates is doubtful. Opinions are divided, though not equally.

Omitting the small section of *disbelievers* in antiseptic treatment, the Profession generally, as *believers*, are divided respecting its *modus operandi*.

The *chemical* theorists attribute the putrefaction observed, to the decomposition induced by the oxygen of the air, a process of oxidation.

The *germ*-theorists attribute the putrefaction observed, to the production of living organisms developed from germs or ova floating in the atmosphere, as constituents of its dust; and not as the result of “spontaneous or equivocal generation,” in the putrifying animal matter.

The balance of *evidence* would seem to be in favour of the latter or germ-theory. The observations of Cagniard Latour, 1836, in the discovery of the yeast plant, followed by those of Schwann of Berlin, in the following year, and the subsequent discovery of minute, jointed, living bodies,—vibrios in putrid matter, supplied the basis of the germ-theory; while the well-known power of the atmosphere to carry and disseminate seeds or dust, completed the theory. The researches of Pasteur seem to have brought it to actual demonstration. Hence, antiseptic treatment would consist, in excluding the atmosphere from wounds, and in interposing some agent which shall destroy the germs in their introduction by any

exposure to the air. Has carbolic acid, or other so-called antiseptics, any such effect? The question is still *sub-judice*.

*Results.*—Comparing the aggregate results of amputations, in the Glasgow Royal Infirmary, Professor Lister finds the mortality to have been:—Before the antiseptic period, 16 deaths in 35 cases, or 1 death in every  $2\frac{1}{2}$  cases; whereas, during the antiseptic period, it was, 6 deaths in 40 cases, or 1 death in every  $6\frac{2}{3}$  cases. This is certainly a greatly diminished mortality, and its significance is more notable from the relative death-rate of amputations in the upper limb; where generally, neither the injuries nor the operations involve much loss of blood or shock to the system, so that if death occurs, it is commonly the result of the wound assuming an unhealthy character. There were 12 amputations in the upper limb, in each of the periods referred to. Of the 12 cases before the antiseptic period, 6 died; but of the 12 during that period, only 1 died, and 11 recovered. The deaths were caused, principally, by pyæmia, erysipelas, and hospital gangrene. Thence, it would appear, may be inferred “the effects of the antiseptic system of treatment upon the salubrity of a Surgical Hospital.”\*

*After-dressing.*—An incised wound should not be disturbed unnecessarily during the process of adhesion. Inflammation can scarcely be said to supervene. In the first instance, it starts this reparative process. Attended with a slight pouting and redness of the lips of the wound; this salutary degree of inflammation should not be repressed; and, being transient, inflammatory fever is not excited, from first to last, if the wound, however extensive and deep, continues to heal by adhesion. The constitution remains calm and impassive throughout the process, taking little or no notice of the local reparation effected by the part itself. Consequently, no antiphlogistic treatment, topical or general, becomes necessary; but the lightest dressings to maintain apposition, and the gentlest handling in applying them, are still sufficient.

The first dressing is not unfrequently the only one nature requires; the wound healing in two or three days, possibly in twenty-four hours. But union is not then secure, nor much before the end of a week in small wounds, and a fortnight in larger incisions. Therefore, during even the shortest period requisite for sound union, the dressings must be changed occasionally; their reapplication having reference always to some obvious and important purpose. Cleanliness, rather than readjustment of the wound, is the guiding maxim for interference. The strip of lint is to be withdrawn wet, not to disturb the lips of the wound, as yet tenderly united. The strips of plaster, also moistened to facilitate their removal, are withdrawn by both ends together gently towards the line of incision, not to undo the work of nature; and each strip is replaced by a fresh one before the next is removed, not to leave any part unsupported. The removal of sutures, if any, will be guided by the progress of adhesion, or by the accidental supervention of inflammation. Within the first twenty-four hours, *some*, at least become useless, or worse,—irritating. These sutures should be picked out, wherever, from point to point, union appears safe, or the blush of inflammation is conspicuous. Otherwise they will ulcerate their way through, and so peril the healing process. In the event of considerable swelling and tension, the lips of the wound having a

\* I have endeavoured to gather the foregoing description of this treatment, and its results, from several monographs which Mr. Lister kindly forwarded to me for this purpose.

tightly puckered appearance at the point of each suture, and a pouting or protruding condition in their intervals; *all* the sutures must be withdrawn forthwith. If thus released, the lips do not adhere, the surfaces may do so, partially or entirely.

The removal of any ligature or ligatures, is, like their application, not necessarily part of the treatment of an incised wound; and will be considered under Wounds of Arteries.

The bandage, if any, and the compresses, if any, are no longer needed when union is sufficiently firm not to risk straining the parts, by the loss of these surface-supports. Generally, the first few days will suffice. Any swelling, however, as in amputation-wounds, may yet require the partial support of a turn or two of the bandage, until tension has subsided.

Thus, one by one, the appliances of Surgery are withdrawn; one by one, these artificial props are removed; until at length, and ere long, in most cases, nature is able to consolidate the union, without further assistance.

Such then is, what I would term, the "conservative" treatment of incised wounds; an example, from first to last, utterly opposed to meddling Surgery.

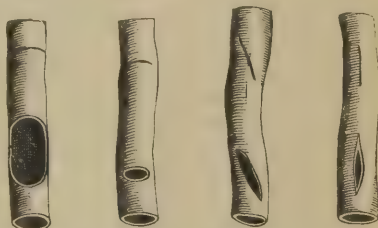
### WOUNDS OF ARTERIES AND VEINS.

These Lesions are conveniently taken next in order.

WOUNDS OF ARTERIES.—*Structural conditions*.—A wound of an artery, like that of any other texture, may be incised, or lacerated; either of which lesions may be partial or complete.

*Incision, partially* extending through an artery, and practically equivalent to a punctured wound, varies in *direction*; being longitudinal, oblique, or transverse, and these are important practical distinctions (Fig. 35); so also is the variation in size of the aperture, which may be of any circumferential extent, short of *complete* division of the vessel.

FIG. 35.



*Laceration, partially* extending through an artery, is limited to one or more of its three coats; the external, and more or less of the middle coats, may be torn through, leaving only the thin inner one entire; or, the two inner coats are severed, leaving only the thick external, cellular coat untruncated. This latter condition of laceration is effected by the surgical application of a ligature. Lastly, all three coats are torn through, if the laceration be *complete*; but the external-cellular coat and cellular sheath, being tougher than the two inner coats, are drawn out from off them, which also retract; thus leaving a canal of loose cellular tissue.

The *Signs* of any such wound of an artery, are hæmorrhage, the blood having a florid red colour, and jetting out from the vessel, *per saltum*, with each beat of the heart; not escaping in a continuous stream of purple or black blood. The force, and in a degree, the rapidity of these jets are regulated by the size of the artery, or of the aperture in it, by its proximity to the heart, and by the heart's action; also by the presence or absence of certain conditions which retard or favour the free flow of blood through the vessel. Thus, pressure on the proximal portion of



artery retards, while a dependent position favours the hæmorrhage. The blood coming from the *distal* portion of vessel is dark, and runs in a trickling stream, excepting from certain arteries, as the palmar and plantar arches, which when wounded, jet arterial blood from either extremity of the vessel.

*Causes, and effects of Wounds of Arteries.*—An artery may be incised or cut with a sharp instrument, punctured with a pointed one, contused or lacerated by a blunt one, or wounded by force of a bruising or wrenching kind.

The operation of any such lesion *locally*, is to produce aneurism, if the blood be imprisoned in the textures; constituting *traumatic aneurism*,—diffused, or eventually circumscribed. Its formation will be specially described in connexion with aneurism. *Constitutionally* regarded; whether arterial hæmorrhage takes place externally, or internally, as into one of the great cavities of the body, its effects are manifested by *syncope* or fainting, more or less complete. And this may occur either by failure of the heart's action, *cardiac syncope*, and thence of the circulation; or as loss of consciousness—*cerebral syncope*; or both modes of syncope may be produced, with a fatal termination, if the hæmorrhage be sufficiently prolonged. These constitutional effects and the probability of death resulting, are proportionate to the quantity of blood lost; not necessarily by its escape *from* the body, but even when lost *to* the body as blood in circulation. Providentially, however, the imminent peril of continued hæmorrhage is lessened by cardiac syncope; suspension of the circulation, tends to arrest the escape of blood from the artery, and by thus favouring the formation of an occluding clot, it tends also to arrest the hæmorrhage.

*Reparation.*—If the vessel be healthy, the lesion is uniformly disposed to heal by coagulation of the blood and the formation of a clot or clots so placed as to arrest the hæmorrhage; a temporary provision, followed by primary adhesion, or, possibly, adhesive inflammation, whereby the vessel is permanently secured or obstructed. But this process of coagulation and adhesion is *modified* chiefly according to the structural kind of wound—incised or lacerated, either of which may also be a partial or complete division of the artery. Then, again, the direction of the wound more particularly modifies the process of healing.

1. An *incised* and *partial* division of an artery is the simplest instance. (See Fig. 35.) If the direction of the cut be *longitudinal* or oblique, it will close more readily than a transverse incision, the edges of which gape and do not fall into apposition. The elasticity of arterial tissue longitudinally makes all the difference, and in favour of *that* direction, aided also, in this case, by the circular contractility of the artery. The line of incision remains closed; blood escaping coagulates betwixt the vessel and its sheath, forming a compress, assisted by any corresponding coagulam which may have formed outside the sheath. The relative positions of the apertures in the artery and its sheath are displaced somewhat by the formation of the intervening portion of clot-compress, thus further tending to arrest hæmorrhage. The homogeneous fibrils, interspersed with many-nucleated corpuscles, of which coagulated fibrine consists, are represented in Fig. 1, p. 42. Associated with blood-corpuscles, it forms the clot. But this clot-compress is a temporary provision only. Adhesion soon follows in the line of incision, the edges being in contact. A *transverse* cut, partly through the circumference of an artery, opens, the



vessel contracting longitudinally by virtue of its elasticity. Adhesion cannot ensue. The aperture is closed by the effusion and organization of lymph *within* the artery, which thus becomes impervious and obliterated. Lost, however, for ever as a blood-conveying tube, hæmorrhage of fatal character is arrested. Nature is still victorious. The *size* of the vessel will somewhat affect the issue, which is otherwise in favour of a longitudinal incision. An artery, like the temporal, with a longitudinal slit, heals without obliteration. An artery of larger calibre, and similarly wounded, becomes impervious and obliterated. And the ultimate success of Nature's effort is apt to be marred, even when the wounded vessel remains pervious; for the internal and middle coats not adhering firmly, this defect predisposes to aneurism.

2. *Complete* division of an artery by incision is healed by a modification of the same process—clot formation, but not as a compress, being the temporary provision, lymph effusion permanently plugging up the vessel. Immediately after its division the artery retracts by its elasticity, longitudinally, into its sheath, which thus projects loosely; the mouth of the vessel contracts, even to a pin-hole opening, by its muscular contractility circularly. The retracted portion thus contracted has a conical shape, like that of a Florence oil-flask or French claret-bottle. (Fig. 36.) Contractility may be sufficient to close the vessel and prevent further hæmorrhage. In this way small arterial branches spontaneously cease to bleed in an open wound exposed to the air, or the action of cold water; but the artery having retracted, coagulation is induced within the loosely projecting filamentous sheath, which entangles the blood as it flows; and this event may be aided by cessation of the stream, owing to failure of the heart's action—cardiac syncope—another resource of Nature for the temporary arrest of hæmorrhage. Coagulation proceeds concentrically. The clot, at first pervious and transmitting a small central stream of blood, soon forms a solid mass, which, still enlarging, passes up the bore of the artery for a short distance in the shape of a small cone. This portion—internal coagulum or *bouchon*—and that in the sheath—external coagulum or *couvercle*—together form a clot, in shape like a glass stopper fitted into a decanter, to which the whole is compared by Professor Gross. The shape of Nature's product is not quite so finished off, for a small portion of the clot is insinuated between the sheath and artery beyond the point of retraction, thereby compressing the arterial aperture, while a still larger portion of an irregular shape projects beyond the aperture of the sheath. The whole clot is, however, continuous, and with these little offsets still bears the resemblance suggested. The permanent closure of the vessel is effected by the effusion of plastic lymph. Like coagulated fibrine, its organization consists, essentially, of fibrils; but those of plastic lymph result from the elongation and attenuation of cells into fibres, in various stages of development. (Fig. 1, p. 42). Corresponding in situation to the clot—*i.e.*, at the aperture, around it slightly, and extending into the vessel, the lymph in-

FIG. 36.



tervenes between it and the clot, which it gradually replaces. During this change the clot varies in appearance, being partly lymph, and partly ordinary coagulum.

The lower end of a divided artery is closed up much in the same way. According to Guthrie's observations it retracts and contracts less than the cardiac end; and the internal coagulum is altogether absent, or very imperfectly formed in many instances.

3. A *lacerated* wound of an artery, if *partial*, may extend through the external and middle coats, leaving only a thin undivided inner membrane, which still continues the channel of communication. Hæmorrhage is imminent. Or the laceration may extend through the inner and middle coats, leaving the outer cellular coat entire. Hæmorrhage threatens, or gangrene may supervene. But if the two inner coats be cut rather than torn, reparation generally takes place and secures the vessel. Such is the kind of injury purposely inflicted by the Surgical application of a ligature, which leaves the external coat undivided; and although itself noxious, as a foreign body in the very pathway of reparation, the artery becomes sealed with plastic lymph, plugged up also with coagulum, and obliterated. The details of this process, thus *artificially* induced by Surgical interference, will be described in connexion with the *treatment of hæmorrhage*.

FIG. 37.



4. *Complete laceration of an artery*—all the coats being torn through—heals without hæmorrhage or scarcely any. The process is the same as that which takes place after division of an artery by incision. But the cellular sheath and outer cellular coat are drawn off the two inner coats, which retract. Consequently the clot that forms in the projecting portion of loose sheath is larger than when the vessel is simply cut across; presenting a bulb-shaped extremity which may extend to half an inch or an inch in length. This appearance is well shown in Fig. 37, which represents a popliteal artery and vein in a remarkable case, both vessels having been ruptured by a violent twist of the knee-joint. Gangrene of the leg ensued, for which I amputated above the knee; with, however, a fatal result.

*Treatment*.—Arrest of hæmorrhage, is the first indication of treatment. *Small* arterial vessels spontaneously cease to bleed, almost immediately; the process of reparation, as appropriate to the injury, at once commencing, and even its preliminary stage proving sufficient to arrest hæmorrhage. Thus, if the vessels be divided entirely across—complete incision—as in most wounds, their cut extremities retracting and contracting soon offer adequate resistance to the escape of blood. This natural provision will be insured by exposure of the wound to cool air, or a stream of cold water squeezed from a sponge. Gentle pressure with the sponge will readily discover whether there be still any oozing from the bleeding points. *Larger-sized* arteries bleed in jetting streams of florid blood, and the resources of Surgical treatment are forthwith necessary to meet such hæmorrhage. These are successful so far as they represent, by imitation, one or other of the natural modes of arresting hæmorrhage.

1. *Compression*—*mediate*, as it is sometimes termed, when not directly applied to the bleeding vessel—may be effected either by the finger or a tourniquet, applied over the parent artery, at the most eligible spot betwixt the wound and the heart. Pressure thus applied is only a temporary resource. *Immediate* compression is effected by pressure directly applied to the bleeding vessels. A compress and bandage, applied firmly, but not with unnecessary tightness, will thus prove sufficient. This mode of compression may be regarded as representing the clot compress of nature.

2. *Ligature*.—The ligature is a Surgical appliance in imitation of a lacerated wound, partially extending through an artery—*i.e.*, through its two inner coats, which are thin and fragile, leaving the thicker and tougher outer coat and cellular sheath untern. The effectual operation of this appliance is—compression of the vessel to induce coagulation of the blood stagnant above and below the ligature, and the effusion of plastic lymph, from the divided coats, to permanently occlude the vessel in both directions; sloughing of the included ring of outer coat and cellular sheath being rendered necessary to detach the ligature. The details of this reparative process, thus induced artificially, are these.

The included portion of external cellular coat and sheath having undergone continued compression, sloughs, and is detached with the thread, in a period varying from twenty-four hours or so to about three or four weeks, chiefly according to the size of artery. Hæmorrhage would then be inevitable; but, pending the detachment of this slough-ring, effusion of plastic lymph, from the vasa vasorum, takes place, whereby the two inner coats become adherent across the area of the vessel, just above and below the ligature. At these points they curl inwards when divided, and, converging, meet together.

This condition was well seen in a femoral artery, and vein (Fig. 38), which I examined five days only after it had been ligatured when the thigh was amputated. A process of organization, therefore, above and below the ligature, accompanies the destruction and detachment of the ring of external coat embraced by the thread. Thus the artery is securely sealed. Accessory, but incidental only, to the prevention of hæmorrhage, are certain changes whereby either portion of the artery contiguous to the ligature is obliterated. The vessel having ceased to convey blood when the ligature was applied; the blood stagnant, above and below, to the nearest collateral branch, has gradually undergone coagulation in the shape of two conical clots, the bases of which accurately plug the artery on either side of the thread. The apex of the clot on the cardiac side tails off, usually opposite the first collateral branch above, through which the stream of blood, now diverted from its course, is carried off from the main. The distal clot is always less defined. At first either clot having the appearance of ordinary coagulum, subsequently it becomes mottled with paler spots, and its substance porous, and ultimately acquires a buff colour, firm consistence,

FIG. 38.





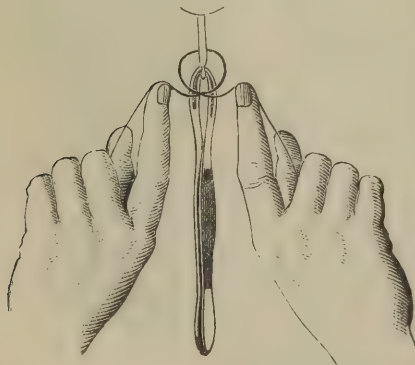
and fibrous texture. Blood-vessels, proceeding from the lymph immediately above and below the ligature, shoot into the base of either clot, and gradually extend towards its apex. Finally, these organized fibrous clots are incorporated with the lymph adjoining, which has acquired a similar structure; the coats of the unused portions of artery degenerating also assume a fibrous character, and the whole is converted into a small, firm, impervious, fibrous cord, extending usually to the first collateral branch above and below. Nature having safely severed the artery—under compression by the ligature—and securely sealed either end, has now obliterated the portions useless as a blood-conveying tube.

An artery of any notable size is most effectually and permanently secured by ligature. *Appropriate*, therefore, for the arrest of hæmorrhage which would otherwise be persistent or recurring and perilous, the ligature is applicable also whatever may be the kind of wound in the vessel, whether incised or lacerated—its extent, partial or complete—and its direction, with reference to the elasticity and contractility of the vessel. The *objections* to ligature are; the production of a slough or sloughs of arterial texture, according to the number of vessels ligatured; the introduction of a foreign body, or as many foreign bodies, into the flesh-wound—a condition proportionately antagonistic to the process of healing by primary adhesion; and, that suppuration consequently, and the sloughs, are provocative of pyæmia. The efficacy of ligature in the treatment of hæmorrhage from wounds of arteries, of flesh-wounds, and in relation to pyæmia, is to be estimated by all these considerations; and thence the value of this method of treatment as compared with that of “acupressure,” proposed to supersede it.

Certain particulars are of great moment in the *application* of a ligature; the observance of which, a due knowledge of the process thus induced for the arrest of hæmorrhage, can alone insure. It is in this light that I specially here advert to them. But they have reference also to the value of ligature, as a method of treatment; for they determine the probability of hæmorrhage recurring or supervening, and also of the healing of a flesh-wound by primary adhesion when an artery or arteries are thus secured.

The practical particulars having this twofold significance are these:—A

FIG. 39.



ligature should be applied to *cut* through the two inner coats of the artery, leaving only the outer more resisting cellular coat and sheath. Hence the ligature must be a small, round, and strong thread—fine silk twist waxed being found to answer best. Applied with sufficient tightness for this purpose, and to induce sloughing of the outer coat by *strangulating* compression. Applied *transversely* across the diameter of the vessel, and tied with a reef-knot (Fig. 39); otherwise the ligature shifting its position and loosening, hæmorrhage

recurs or supervenes when adhesion is not yet sufficiently advanced to



safely seal the vessel. Applied so as *not* to include any *extraneous* texture—a bit of muscle, a vein, or nerve; for then the twofold effect on the artery enclosed may not be produced, or sloughing may proceed more speedily in the extraneous texture than in the arterial coat, the ligature become loosened, and hæmorrhage supervene. Inclusion of a nerve-filament causes also great pain at the time, and for a considerable period in some cases. An imbedded artery may be inaccessible without including some other texture. In the most inaccessible situations—as when, by amputation, the anterior tibial artery is divided at its origin and deep in the muscles between the heads of the tibia and fibula—it is absolutely necessary to “dip” for an artery so placed. A curved needle armed with a ligature is thus carried round the vessel, and the thread tied as usual, but including as small a quantity of extraneous texture as possible. On the other hand, the ligature should *not* be applied to any *projecting* portion of the artery; the vessel being there denuded of its own nutrient vessels (*vasa vasorum*), plastic lymph is not effused, and when the slough-ring separates, hæmorrhage is inevitable. Regarded as a *foreign body*, antagonistic to healing by primary adhesion, one end of the ligature is usually cut off close to the knot on the artery, leaving only the other end to command the noose, thus reducing the quantity of foreign body in the wound by one half. The ligature or ligatures may be brought to one or other angle of the wound, and there fixed by a small piece of plaster, thus also limiting any defective adhesion to the narrow track occupied by the thread or threads. Practically, it is found they do not much interrupt the process of healing or delay the issue.

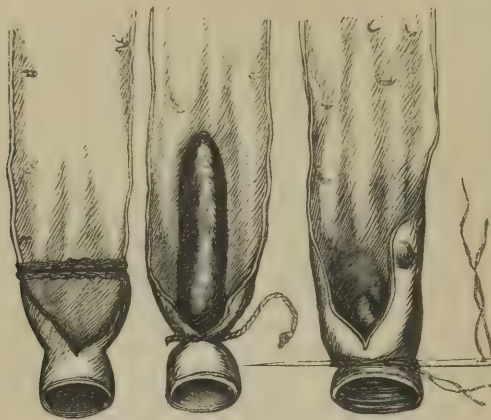
Duly observing all these suggestions of pathology, the constructive part of the process—adhesion—will generally accompany the destructive—sloughing—with even progress, and the issue of both will be contemporaneous; permanent closure of the vessel accompanying the separation of a ring of slough with the ligature. The security of the vessel is safely ascertained by gently twirling the thread between the thumb and finger. A yielding sensation shows that Nature has done her work, and that the ligature detached can be withdrawn without the risk of hæmorrhage. This, however, cannot be expected, nor should the experiment be tried before sufficient time has elapsed—the *period* varying from twenty-four hours to as many days or more, chiefly according to the *size* of the artery.

3. *Acupressure* has been proposed by Sir James Simpson as a substitute for ligature. It is essentially the “temporary metallic compression” of an artery,\* and it may be accomplished in either of three ways:—(1) By passing a long needle twice through the flaps or sides of a wound, so as to cross over and compress the mouth of the bleeding vessel or its tube; just as in fastening a flower in the lapel of our coat we cross over and compress the stalk with the pin which fixes it, and therefore pass the pin twice through the lapel. In this method a long needle is introduced from the cutaneous surface, and its extremities left out *externally*. In both the other methods a common sewing-needle, threaded with iron-wire, is used. The needle is introduced on the raw surface of the wound, and is therefore placed altogether *internally* or between the lips of the wound. The wire is only for the purpose of withdrawing the needle when no longer required. (2) In one of the methods referred to, the needle is dipped down into the

\* *Acupressure*. 1864.

textures a little to one side of the vessel, then raised up and bridged *over* the artery, and finally dipped down again into the textures on the other side. This method, therefore, is the same as the first, but that the needle is applied altogether on the raw surface of the wound and over the artery, which it compresses. (3) The third method consists in passing a needle

FIG. 40.\*



*under* the vessel, transfixing the textures once. A loop of wire is passed over the point, and fastened round the eye end by a single twist, thus compressing the artery and some surrounding tissue between the needle and the wire. This method Sir James Simpson believes to be the one which will probably be most frequently practised (Fig. 40).

In one form or other acupressure is said to be superior to ligature, both with regard to the improbability of *secondary hæmorrhage*—the probability of *healing by adhesion*, and the improbability of purulent, or other septic *infection of the blood, pyæmia*.

(1) Respecting *hæmorrhage* after amputations, in eleven cases of acupressure only one was followed by secondary hæmorrhage; whereas in eleven cases of ligature, four of secondary hæmorrhage occurred, of which two were fatal. Such were the comparative results after amputations at the Carlisle Hospital (Hamilton's Report). In other words, in that institution, secondary hæmorrhage from ligature and from acupressure was as four to one in eleven cases. Other favourable results might be added. The most recent report is that of Professor Pirrie,† who, with Dr. Keith and Dr. Fiddes, have more especially practised and advocated this mode of arresting arterial hæmorrhage. The former thus enumerates his "experience in important cases, of which records have been kept. Eleven cases of amputation of thigh, four of amputation of leg, two of amputation of arm at the upper part of the surgical neck of the humerus, one of amputation at ankle-joint, one of Chopart's amputation, two of amputation of the whole of great toe, twelve of excision of mamma, six of excision of elbow-joint, one of excision of knee-joint, one of excision of an erectile

\* Occlusion of Arteries; the femoral arteries, after Acupressure, and Ligature—in double amputation—each twenty-four hours. (Author.)

† British Medical Journal: Annual Meeting of the Association, Dublin, 1867. See also Acupressure.

tumour, one of excision of tumour on chest, one of excision of tumour on thigh (wound eight inches long), one of excision of head of fibula, three of excision of testicle, one of hæmorrhage from sloughing of hand, one of wound of hand, one of wound of upper part of forearm with great hæmorrhage, one of wound of radial artery, and one of wound of hand attended with great hæmorrhage—in all fifty-one cases, in which I have acupressed 185 vessels.”

But experience has not yet sufficiently accumulated to determine the relative value of these two kinds of treatment with reference to the improbability of hæmorrhage supervening. Nor had pathology hitherto determined this question. “We want,” acknowledged Sir James Simpson, “a series of proper experiments and observations as to the actual *pathological mechanism* by which acupressure occludes the mouths and tubes of arteries, before we can attain fixed ideas as to its progress and completion.” Accordingly, in the year 1867, I endeavoured to supply this *desideratum* by post-mortem examination of the process of occlusion in arteries, after acupressure, and its relation to the treatment of surgical hæmorrhage, compared also with ligature and torsion. The results of my observations were communicated in a Paper to the Clinical Society, in 1871. Previously, the observations of Mr. H. Lee, and Mr. J. W. West, respectively, relative to acupressure were brought before the same Society. The practical object of my inquiry was, by a due knowledge of the *process* of occlusion, to determine the proper period for the safe withdrawal of the needle from a main artery, as the femoral, and the various periods in respect to different sized arteries; rather than having recourse to the perilous mode of investigation, by tentative experience on living patients, in the treatment of hæmorrhage by acupressure. Thus would be determined the liability of secondary hæmorrhage occurring in this mode of treatment.

*Occlusion*, after acupressure, consists, essentially, in the formation of a conical clot, adjoining the transverse line of acupressure, or needle; this clot increases in length, extending up probably to the first collateral branch of artery, and it increases also in calibre, so as to completely occupy the bore of the vessel at, and for some distance adjoining the line of acupressure. Thus the artery is plugged (Fig. 41). This clot soon undergoes structural changes; becoming fibrinous in its distal portion, partly fibrinous, eventually perhaps entirely so, in its proximal portion, and there adherent to the interior of the artery. Further changes, I have not yet traced. But, it would seem highly probable that the occluded portion of

FIG. 41.\*



\* Occlusion of femoral artery after Acupressure—in amputation—five days. (Author.)



artery atrophies, and undergoing degeneration into a fibro-cellular cord, as after ligature, thus becomes permanently obliterated. In conjunction with this series of changes, as affecting the blood in the artery, and eventually the vessel itself; there are, however, no changes at the seat of acupressure—no division of the inner and middle coats of the artery, and their inversion or reduplication, and no subsequent deposition of lymph with adhesion of the divided coats of the vessel; the integrity of the artery remains unaffected by the compression of acupressure, temporarily applied, the needle serving the purpose merely of preventing the escape of blood as primary hæmorrhage, while, by arrest of the passage of blood, coagulation may be induced, and thus secondary hæmorrhage prevented when the needle is withdrawn. A firm, fibrinous, and adherent clot, was found to have formed within five days, and in a main artery—the femoral.

In *treatment*, by acupressure, therefore, the proper period for the safe withdrawal of the needle, may be inferred to be, at that period, if not earlier; without liability to the occurrence of secondary hæmorrhage.

(2) With regard to the probability of *adhesion* taking place between the *surfaces* of a wound, the arteries of which are secured by acupressure; it is alleged that the needles are, as foreign bodies, merely temporary, while their material is less irritating than that of ligatures; and that they are not intended or allowed to produce sloughing of the compressed arteries, whereby foreign bodies of worse character, in the shape of slough-rings of the cellular coats of these vessels, are produced and remain between the raw surfaces—with, moreover, suppuration. (3) Hence, also, the greater probability, apparently, of *pyæmic infection* supervening after ligature. And certainly the observations of Professor Pirrie are here to the point, not a single instance of pyæmia having occurred in his experience where acupressure has been employed by himself or his Hospital colleagues at the Aberdeen Hospital.

4. *Torsion of cut arteries*, is another method of arresting hæmorrhage, which may be regarded as an imitation of another natural process of cure. Torsion is effectual by laceration of the two inner coats of the cut end of a bleeding artery, the outer coat remaining as a loose filamentous sheath, which, entangling the blood and forming a peg, is equivalent to an accidentally *complete* laceration.

This procedure originally noticed by Galen, was revived about 1828; in France, by Amussat, Velpeau, and Thierry; and in Germany, by Fricke. In this country, recently, torsion has been practised more generally, and it seems to be attracting increasing attention. Arteries of *small* size had long since, occasionally, been commanded by a pinch and twist with the forceps; but *large* arteries, as the femoral, brachial, ulnar, and radial, have been effectually secured by torsion, in amputations of the thigh, arm, and fore-arm, as previously practised by Amussat and Velpeau.

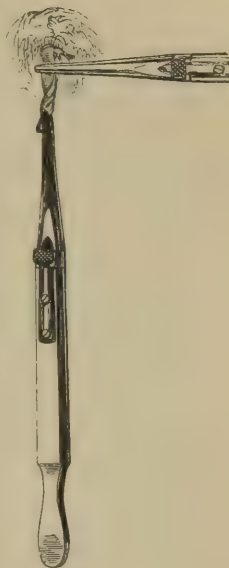
*Occlusion* by Torsion, has been specially investigated by Mr. Cooper Forster, whose observations are published in the Trans. Clin. Society, 1870. My own observations in one case, death taking place in thirty-six hours, were communicated to the same Society, in 1871. Occlusion consists in the following changes:—At the seat of torsion, the two inner coats of the artery are torn across, and reduplicated up the vessel, perhaps in the form of a complete funicular sheath, one-fifth of an inch in length; and at the upper or smaller opening of this reduplication, or funnel, a conical blood-clot forms, occupying the bore and extending up the vessel

(Fig. 42) The twisted condition of the artery, itself usually a persistent change, and the reduplicated sheath, of the two inner coats, above, acting as a valve, are quite sufficient provision against the recurrence of hæmorrhage at the time of operation and subsequently; but there is also the supervention of clot-formation from this sheath, and extending further up the bore of the vessel.

FIG. 42.\*



FIG. 43.



Different *modes* of torsion have been recommended, and are practised. The artery may be drawn out for about half-an-inch by one pair of common serrated forceps, and its attachment seized by another pair of serrated forceps; the free portion is then twisted off by about a dozen turns of the former instrument—the method of Amussat. (Fig. 43.) Or, the end of the vessel may be simply twisted several times, without detaching it; as recommended by Velpeau and Fricke. This is the method I ordinarily practise, scarcely ever employing ligature to any artery, of whatever size; it has been much practised also by my colleague, Mr. J. D. Hill,

and it is I believe generally preferred. *Torsion-forceps* are now used; the instrument being furnished with transversely serrated points, and closed by a slide when the end of the vessel has been seized.

*Comparison of Ligature, Acupressure, and Torsion.*—The *occlusive process*, in the changes which the artery and contained blood undergo by ligature, acupressure, and torsion, may be thus summarily stated:—firstly, in all three, conical clot-formation and plugging of the vessel, adjoining the line of compression, or of twist; and, in acupressure, this is the only provision against the supervention of hæmorrhage, when the surgical appliance—the needle—is withdrawn. Secondly, in both ligature and torsion, division of the inner and middle coats of the artery, transversely, at the line of operation; followed by lymph-deposition and sealing of the vessel. This is the only additional provision against the supervention of hæmorrhage, when the ligature separates; but in torsion, the twist of the vessel is persistent, and reduplication of the divided coats, probably in a funicular form, acts also mechanically, as a valve, against the occurrence of hæmorrhage. In relation to the *treatment of hæmorrhage*—by acupressure, the formation of a clot-plug might seem an insufficient provision to prevent its recurrence, when the needle is withdrawn, that secondary hæmorrhage would then take place; yet the results of experience, already referred to (p. 262), have shown that

\* Occlusion of brachial artery after Torsion—in amputation—thirty-six hours. (Author.)

this single provision is sufficient, without the additional security of lymph-deposit and sealing of the vessel, as at the line of ligature or of twist; or the extra and mechanical security afforded by the persistency of the twist, and the funicular valve of lining membrane. But assuming the liability to the occurrence of secondary hæmorrhage to be about equal after either of the three methods of surgical treatment; the tendency to *primary union* of the flesh-wound, and the prevention of *pyæmic infection* of the system, must be very different. Torsion has decidedly the advantage over either ligature or acupressure, in regard to both these very important considerations. The twisted portion of an artery not being killed, as its subsequent adhesion shows, no sloughing of the end of the vessel ensues—when this portion is allowed to remain in the wound; yet this event necessarily and intentionally ensues after the application of ligature, or accidentally by prolonged acupressure; and no other foreign body is allowed to remain in the wound, for however short a period, to possibly provoke suppuration, as after both these methods of treatment.

**WOUNDS OF VEINS.**—The same forms of injury may occur as those to which arteries are liable, and they having been already sufficiently described, need not be repeated.

The *Signs* of any such wound are venous hæmorrhage; the blood of a purple or black colour and flowing in a continuous stream, unlike the jetting of florid red blood from an artery. The force, and in some degree the rapidity, of this stream, are regulated by the size of the vein, or of the aperture in it, by the heart's action, and its effect on the flow of venous blood; and by the presence or absence of certain conditions which favour or retard the free flow of blood through the vessel. Thus, pressure on the vein between the aperture and the heart, a dependent position of the part, and muscular action in the course of the current, favour the hæmorrhage; while, the opposite conditions retard it.

*Causes, and Effects of Wounds of Veins.*—Like an artery, a vein may be incised or cut with a sharp instrument, punctured with a pointed one, contused or lacerated by a blunt one, or injured by force of a bruising or wrenching kind. The operation of this lesion is, *locally*,—to induce diffuse inflammation of the vein,—diffuse phlebitis, if the wound be an open one, or to produce a collection of venous blood—blood-tumour, if the fluid be imprisoned in the textures. This condition will be described under Contusion. *Constitutionally*, whether venous hæmorrhage takes place externally, or internally into one of the great cavities of the body, its effects are manifested by *syncope*; either by failure of the heart's action—cardiac syncope—and thence of the circulation, or by loss of consciousness—cerebral syncope; or by both these effects, and their fatal termination if the hæmorrhage be sufficiently prolonged. These constitutional effects and the probability of death resulting, are proportionate to the quantity of blood lost, not necessarily by its escape from the body, but, even when lost to the body, as blood in circulation. Such consequences are less apt to ensue from venous than from arterial hæmorrhage; but another constitutional disturbance is *specially* liable to occur from an open wound of a vein, and more so, the larger the vessel. Air is thus apt to enter the circulation, attended with a whirling, bubbling, sucking, or lapping sound; the individual feels death-struck, he moans and breathes heavily, becomes very faint, and probably dies, in a few minutes, or at the most, in a few hours.



*Reparation.*—Wounds of Veins heal by processes apparently analogous to those whereby similar Wounds of Arteries are repaired.

*Treatment.*—The arrest of venous hæmorrhage may be accomplished, by an elevated position of the part, and the pressure of a compress secured by a few turns of a roller. Cold or astringent lotions are also of some service. Ligature should be avoided, as being apt to induce phlebitis. But this resource may be necessary in the case of a large vein, or if the vessel be so situated that pressure cannot be applied.

The treatment of diffuse inflammation of a wounded vein will be considered under the head of Phlebitis; and the remedial measures appropriate to the formation of a blood-tumour, in connexion with Contusion.

*ENTRANCE OF AIR INTO VEINS.*—The fatal result or the extremely perilous symptoms arising from the forcible introduction of air into the veins of animals, had long been known; and was at length made the subject of experimental observation by Morgagni, Valsalva, Bichat, and Nysten. But, in Surgical Practice, the accident first occurred in the experience of M. Beauchesne in 1818, during an operation for the removal of a tumour from the lower part of the neck. It was necessary to disarticulate and raise the clavicle; and while this was being done, the patient became faint, exclaimed "I am dying," and expired in less than a quarter of an hour. Dissection revealed a small wound in the internal jugular vein at its junction with the subclavian and the entrance of air through that wound caused the fatal result. The accident has since happened in the practice of Mirault, Clemot, Roux, Magendie, Castara, Dupuytren, Delpech, Bégin, B. Cooper, Erichsen, Warren, Mott, Stevens, and other Surgeons, both in Europe and America. A Commission of the French Academy was appointed to investigate the subject; and the names of Magendie, Amussat, Wattmann, and Cormack, are distinguished for the light their labours have thrown on the pathology of the entrance of air into veins.

*Symptoms.*—The *local* phenomena consist in a peculiar sound, of a hissing, gurgling, lapping, or sucking character, produced by the entrance of air, and the appearance of bubbles about the wound in the vein. The *constitutional* effects are equally remarkable; the patient is suddenly seized with great oppression in breathing, and extreme faintness, convulsive struggling, and a horrible feeling of terror and impending danger, inducing him to exclaim that he is dying. A churning noise is heard in the heart, synchronous with the ventricular systole; and the hand applied to the chest, perceives a peculiar bubbling, thrilling, rasping sensation, produced by the air and blood being whipped together within the ventricle. The heart's action becomes extremely feeble, and the pulse almost imperceptible. When only a small quantity of air has entered the circulation, the symptoms may pass off and the patient rally. A larger admission of air speedily causes death, during the convulsive struggling, or without convulsions, as if by simple syncope. The *period* at which death occurs varies, from a few moments or minutes, to several hours. When the patient survives, some hours elapse usually, before consciousness and strength are restored. In some cases, after recovery from the immediate effects of the accident, death has ensued from pneumonia.

The *mode* of death seems to be essentially asphyxia, by arrest of air-bubbles in the capillaries of the lungs, mechanically obstructing the pulmonary circulation; thence cutting off the systemic circulation, and

the supply of arterial blood to the brain, followed by syncope. Thus the heart's action continues, after respiration has ceased; and at last failing from want of its necessary stimulus, arterial blood, this organ is the *ultimum moriens*.

*Cause*.—Air enters the veins only during each act of inspiration; and in consequence of a tendency to the formation of a vacuum within the thorax, more particularly in the pericardium, during inspiration. Thence a sucking action, or “venous inspiration,” in the veins within and near the thoracic cavity; extending only to where the coats of the veins collapse. This area is limited to that part of the root of the neck and axilla where the venous flux and reflux of blood are perceptible, and the space in which it occurs has been called “the dangerous region.”

Circumstances favouring the accident:—1. The site of the wounded vein being in the dangerous region. 2. Canalization of a vein; owing to its coats being thickened by morbid deposit, or adherent to condensed, consolidated surrounding textures, or by spasmodic contraction of muscles; any of these three conditions having the effect of converting a vein into a rigid, uncollapsing tube. 3. Traction on the vein. 4. A stretched position of the part operated on. 5. The form of the wound. 6. The position of the vein in the wound; a vein cut in the corner of a wound being apt to gape, as Dupuytren's case demonstrated. 7. Deep inspiration.

*Treatment*.—*Preventive* measures consist—in making pressure on the cardiac side of the wound, during operation in dangerous localities; maintenance of a relaxed position of the part, and prevention of the stretching of veins. Any vein of considerable size, and especially in which the venous pulse is perceptible, should be avoided as much as possible. Feeble inspiration is desirable, and this is best secured by the influence of chloroform; tightly bandaging the chest to prevent deep inspiration, as some have recommended, is a perilous precaution. *Curative* treatment comprises the fulfilment of the following indications:—1. To maintain an adequate supply of blood to the brain, for the prevention of death by syncope. The patient should be placed recumbent, with the head low, and pressure should be made on the axillary and femoral arteries, so as to direct the circulation towards the brain. 2. To maintain the action of the heart by artificial respiration, and friction at the præcordial region. 3. To promote the removal of obstruction in the pulmonic capillaries, also by artificial respiration. 4. After recovery, to treat the tendency to inflammation of the lungs.

## CHAPTER XV.

### CONTUSION.—CONTUSED AND LACERATED WOUNDS.—PUNCTURED WOUNDS.

*CONTUSION*.—*Structural Condition*.—Contusion is a laceration of the *soft* textures, *subcutaneously*; the skin remaining unbroken, whereby the textures, thus injured, are protected from the air. This kind of lesion, therefore, is the connecting link between other subcutaneous lesions, by laceration, as simple fracture and dislocation; and openly lacerated, or contused wounds, compound fracture and similar dislocation; the turning

point being, exclusion from, or exposure to, the action of the air. Subcutaneous laceration of the soft textures is necessarily attended with some hæmorrhage, also subcutaneous, but which extends inwards according to the depth of the contusion. The *degree* of laceration is proportionate to the force applied externally, and to the molecular cohesion of the textures affected; the quantity of blood effused, is regulated, partly by these circumstances, but chiefly, by the vascularity of the textures; while, the effusion itself is finally determined by the resistance offered by the textures which, with the blood accumulated, together act as a compress upon the lacerated vessels.

*Signs.*—The blood, diffused into the textures interstitially, and especially into the cellular texture, is said to be *extravasated*; instead of being discharged out of the body as in ordinary hæmorrhage. Any portion of the blood which has accumulated in the cellular texture under the skin, or is thus more immediately subcutaneous, is made visible through the integument; and hence the appearance of a livid or black discoloration, the ordinary appearance of *bruise*, as seen in the first instance. If only a small quantity of blood be extravasated here, or elsewhere, the appearance is designated *ecchymosis*. Blood extravasated in considerable quantity may still present the appearance of bruise, but have also the fluid and fluctuating character of an abscess. A hard *circumscribed* boundary can also perhaps be felt. Puncture, in appropriate situations, with a grooved needle and examination of the fluid with the microscope, will determine a doubtful diagnosis. The discoloration of contusion bears a general resemblance to gangrene, but the temperature and sensibility of the part are retained, at least in a higher degree than in that condition. When extravasation of blood has taken place, deeply, and possibly into internal organs, it is declared by *functional disturbances* of a less definite character, and which of course vary with the part to which contusion thus extends.

*Causes, and Effects of Contusion.*—External force in the shape of pressure or a blow, may *directly* produce contusion; or the force may be applied *indirectly*, at some distance from the part affected. But the state of the textures may *predispose* to this kind of lesion. The elastic firmness and comparatively bloodless condition of the flesh of a prize-fighter, who has undergone "training," contrasts favourably with the flabby bloated face of one who is "out of condition," as that of the intemperate debauchee, which is ever bordering on ecchymosis.

The operation of this lesion, *locally*, is identified with its course; while its effects *constitutionally* are those which arise from other forms of Injury, and hæmorrhage; but the syncope arising from contusion is due more to the injury, itself possibly extensive and severe, than to the extravasation of blood. Therefore, the shock of injury, as manifested by the nervous system, predominates; or tetanus may supervene. [P. p. 432.]

*Course.*—The natural course of Contusion is twofold; inclining, on the one hand, to reparation subcutaneously; on the other, to sloughing, the formation of an open wound, and reparation subsequently by the process of suppurative granulation. Thus, no perceptible alteration may take place in a contused part, the bruised appearance remaining for a variable period; but absorption supervening, the originally purple or livid discoloration of a bruise fades away into a greenish or yellowish hue. Blood extravasated in considerable quantity may also remain



stationary, as a bag of fluid. But it generally undergoes changes of consistence, becoming thin and serous, and enclosed in a fibrous cyst, or thick and dark like treacle, constituting a sanguineous tumour—*hæmatoma*; or with coagulation, organization of the clot may ensue by the development of new blood-vessels. In either of these subcutaneously reparative alterations, the blood corpuscles undergo disintegration to some extent; and hence, apparently, the changes of colour, followed by absorption; and it can scarcely be doubted that the damaged structural condition of the textures is more or less reinstated. But the intimate nature of all these reparative alterations, after contusion, requires further investigation. Lastly, the most obvious change may be destruction, prevailing over any reparative effort; the blood, acting as a foreign body, induces inflammation, the products of which, commingling, form a bloody purulent fluid, extravasated amid the disintegrated textures. Gangrene is imminent, an event the more apt to ensue according to the severity and extent of contusion; gangrenous disintegration of the textures then appearing either as sloughing, or as traumatic gangrene, and converting the subcutaneous lesion into an open lacerated wound. *Hæmorrhage*, superadded to the blood originally extravasated, is another adverse issue, but less common, unless in internal organs.

Reparation by the process of suppurative granulation will be described more appropriately in tracing the course of a contused or lacerated wound.

*Treatment.*—The earliest occasion for interference is determined, not by the presence of contusion, which is naturally disposed to undergo reparation subcutaneously; but it depends on the degree of contusion and the quantity of blood extravasated. A slight ecchymosis disappears spontaneously; a more severe bruise may need help.

The *indications* are, in the first instance, to promote *absorption*, without any breach of the integument. Various topical applications have reputed efficacy. *Arnica*, I think, possesses some virtue. The tincture diluted, in the proportion of an ounce to half a pint of water, is perhaps more efficacious than spirit lotion, or any other cold evaporating fluid. Leeches are not merely useless to withdraw the blood, congealed and infiltrated; but by admitting air, and thus inducing decomposition, they are positively noxious. Moreover, they are apt to excite sloughing of the skin. Should gangrene threaten, whether from the blood acting as a foreign body, from the severity and extent of the contusion, or from both these conditions co-operating; then, indeed, *incisions*, early and free, are imperative, to give vent to blood and pus which would otherwise rapidly putrify, and to prevent sloughing, or its progress. In short, any attempt to aid restoration is now too late or inappropriate, and the rule of treatment should be to anticipate if possible, or at least accompany, the work of destruction, and forthwith remove its results. Accordingly, in the event of traumatic gangrene, amputation may become justifiable, as an extreme and rare resource.

**CONTUSED and LACERATED WOUNDS.**—*Structural Condition.*—These forms of Injury, although nominally distinct, in regard to the kind of force by which they are produced, are essentially the same. A contused or a lacerated Wound, is a sudden disintegration of the *soft* textures, with *exposure* to the action of the air. In the latter respect, wounds of this kind differ from contusion,—a subcutaneous lesion; and in virtue of the former particular, they differ from compound fracture and compound

dislocation, wherein the lesion itself is not exclusively laceration of the soft textures, these parts being involved only by the injury.

The *characters* of a lacerated wound are peculiar. It presents a torn irregular surface or cavity, with more or less surrounding swelling and discoloration, owing to effusion of blood beneath the skin, or ecchymosis. Hæmorrhage from the wound itself is inconsiderable; the vessels being lacerated. With these external appearances, the degree of pain experienced would seem to be inversely proportionate to the extent and depth of the laceration; for this kind of injury implies a corresponding destruction and death of the textures. The pain is heavy and aching. The structural alterations produced by laceration, and thence the characters of a lacerated wound, are somewhat modified by the extensibility, elasticity, contractility, and other properties of the textures. The resulting appearances are most conspicuous when a limb is drawn off, as by machinery; or abruptly struck off, as by gun-shot injury. Some textures are comparatively unyielding, and their torn extremities hang out of the stump; others break off short within the general mass. Thus, the skin being tough and elastic, it either yields higher than the included textures, or it retracts, exposing them; the muscles protrude and are everted; the tendons resisting with greater tenacity, they hang out of the stump, or giving way higher up, they are pulled out of their sheaths; nerves, for the most part break off at the surface; the vessels, especially arteries, possessing considerable elasticity, are drawn out to some length, their inner and middle coats yielding, while the external coat is prolonged over them; and their torn ends retracting, they become less pendent and exposed than any other part of the stump; lastly, the bone, having broken off abruptly, it forms the most prominent point. The stump, therefore, presents an irregular conical form, with the truncated bone as its apex.

*Causes, and Effects of Lacerated Wound.*—The force applied may be chiefly lacerating, as when an arm is drawn in between two revolving cog-wheels; or it may be chiefly contusing, as the action of a cannon-ball or other projectile. In either case the part is damaged beyond, and perhaps far beyond, the apparent extent of injury.

The *constitutional* effects of a contused or lacerated wound are those already noticed with reference to other forms of Injury, and hæmorrhage; but the syncope arising from such lesion is due more to the injury, itself possibly extensive and severe, than to the extravasation of blood. The shock of injury is always severe, sometimes overwhelming; tetanus also is apt to supervene, especially after any such wound of the hand or thumb, of the sole of the foot or of the toes. [P. p. 442.]

*Locally*—the textures, disintegrated by violence, inevitably die, to a greater or less extent. This event, which is strictly speaking *traumatic* gangrene, on however small a scale, takes place in one of two ways, or both may co-operate. Severe contusion or laceration kills the part outright; or it does so indirectly, by damaging the blood-vessels some distance off; in which case mortification is occasioned by an intervening and internal condition—deficient supply of blood to the part. In both cases, gangrene is *immediate*, or at least immediately commences; it evinces *no* tendency to *spread* beyond the seat of injury, and, in due time, is *defined* by sloughing, or by “a line of demarcation” when the injury is more extensive.

*Course.*—(1) *Gangrenous Inflammation* almost invariably supervenes,

perhaps extensively, and thus textures or a part which may not have been killed more immediately by the injury, die subsequently. Yet such gangrene also is limited to the seat of injury, and is defined by sloughing. Gangrene may, indeed, supervene on a contused or lacerated wound, without any apparent or notable inflammation, and extend far beyond the seat of injury; a whole limb speedily falling into gangrene, which spreads rapidly and is not determined by a line of demarcation. This, which has been named *spreading* traumatic gangrene, is traumatic only in that injury is the immediate or exciting cause; but its spreading and unlimited character points to some blood-condition, in operation, as the essential cause. In fact, this gangrene is the local manifestation of a constitutional condition, rather than the consequence of a local cause in operation. Its pathological significance is corroborated by two facts—that the contusion or laceration is quite subordinate in extent to the supervening gangrene; and that it occurs in those persons especially who have albuminuria, a state of urine indicative of the retention of excrementitious matters, chiefly urea, in the blood.

Either form of gangrene is always humid or moist, unlike the dry species of which senile gangrene is the representative. When a part is killed immediately, the appearances are those of the most severe contusion or bruise; when less immediately completed, as by injury to the blood-vessels, the symptoms are the same, but proportionately more gradual; and when gangrenous inflammation supervenes, the symptoms are those of inflammation rapidly passing into gangrene. But when spreading traumatic gangrene takes place, the phenomena are those of a severely poisoned wound. Gangrene is announced by great tension and livid or purplish-black discoloration, which although most conspicuous about the seat of injury, extends rapidly upwards and downwards; its progress being preceded by a slighter œdematous swelling and greenish-yellow discoloration. This, in advance, is a dying part; that, in the rear, is already dead. Emphysematous crackling, under pressure with the finger, soon leaves no doubt that death and decomposition go hand in hand. The accompanying constitutional symptoms are those of typhoid blood-poisoning; and the disease generally terminates fatally in a very few days, not later than whenever the gangrene shall have spread to the trunk.

(2) *Reparation*.—In favourable contrast with any tendency to death; the wound may evince a disposition to heal by primary adhesion, or, any irrecoverable part having sloughed and separated, the exposed surface heals by *suppurative granulation*. The process is, then, briefly this:—The local circulation is temporarily suspended. A thin coagulable lymph oozes from the surface, and forms a fibrinous film, in which white corpuscles of the blood abound. Thus the whole surface becomes glazed over, excepting perhaps any portion of fat or bone, which textures yield scarcely any, if any, such lymph. A period of *inactivity* follows, lasting from one day to ten or more, but varying with each particular texture in the wound. Some further oozing of lymph and thickening of the film may, however, continue during this period. At length, a distinct afflux of blood more than restores the circulation around the seat of injury. *Reparative* lymph begins to flow, which mingles with or displaces that which has hitherto glazed the wound. This lymph undergoes the same process of organization as in healing by adhesion—namely, self-development into fibro-cellular tissue. The deepest cells are most advanced; they are



elongated nearly into fibres. (Fig. 44.) The superficial ones remain in a rudimental state, and at length acquire the character of epithelial cells. Capillary blood-vessels spring from below, forming loops, as also seen in the figure. Each new vessel is constructed by the outgrowth of two pouches from a parent vessel. The pouches, crammed with blood-corpuscles, shoot upwards, and curving inwards, never fail to meet exactly in apposition, neither segment overshooting. They coalesce by absorp-

FIG. 44.



tion of the partition at the junction of their closed ends, thus completing a vascular loop, through which the blood, diverging from the main current and rejoining it, is continuously propelled. If, in the construction of any such vascular arch, the pouches burst, the process is then completed by the propulsion of the blood-corpuscles, the current of blood from the parent vessel being directed so skilfully as to channel a curved passage through the fibro-cellular tissue. Nerves and lymphatics do not apparently enter the substance of granulations.

The process of development having finished, healthy granulations are seen in the shape of small conical papillæ, of a glistening red colour when free from pus. The *pus cells* in suppurative granulations are either degenerate or immature granulation-cells. If the former, pus represents the *superficial* portion of organized granulation material, which, having lived its time, passes off, just as epithelial cells are detached. If immature granulation-cells, pus represents the *superfluous* portion of organizable material, which never reaches maturity. This is the more probable interpretation, considering the structural similarity or identity of pus-cells. As *immature* granulation-cells, pus ceases to be secreted when the granulations come to the level of the skin, for then, the wound or chasm being filled up, no more organizable material is needed.

Sometimes during the granulating process, granulations from opposed surfaces meet together. They may then unite—a conjunction designated “secondary” adhesion, to nominally distinguish it from adhesion primarily, as between the surfaces of an incised wound. But it takes place in the same way, by the development of fibres out of nucleated cells and the interchange of capillary blood-vessels through this medium of communication. The contractile force of granulations is supplemental to reparation in bringing down the marginal skin to their own level and diminishing the area of the wound. Thus, then, by their actual growth and possible

coalescence, aided by their contraction, granulations and skin at length become even.

*Cicatrization* commences, its purpose being to cover the granulations with skin. The marginal skin advances as a white line, preceded by a translucent bluish-white line of cuticle around the circumference of the sore. Converging, the surface gets covered; sometimes little islands of new skin form here and there, which coalesce, and shorten the process of marginal cicatrization. Newly formed and healthy *cicatrix* is thin and red, with a stretched, shining aspect, and not so supple and elastic as true skin; somewhat depressed, sometimes elevated, and always moveable. It contracts for a long while, and with considerable force, especially after burns, and acquires a pearly-white colour. It gradually becomes more supple, elastic, and moveable as part of the integument. Nature has healed, and almost effaced, the wound.

The *Prognosis* of Contused and Lacerated Wounds may be gathered, as with regard to other injuries, from a due consideration of their nature and course. It is less favourable than that of an Incised Wound; owing to the kind of structural *disorganization* in contusion or laceration. Gangrenous disintegration of the textures in a greater or less degree, is inevitable; or gangrenous inflammation, with sloughing and suppuration. The *extent* of the lesion will, therefore, much affect the issue. *Spreading gangrene* is an adventitious condition, but it is the most unfavourable consequence of contusion or laceration, as implying the co-operation of a *constitutional* cause. Healing by primary adhesion is exchanged for the slower and perhaps less effectual process of suppurative granulation; yet the latter being another mode of Reparation, must be regarded as an *eventually favourable* element in the prognosis of the lesion under consideration.

*Treatment.*—In all *superficial* wounds, contused or lacerated, and especially of vascular parts, as the scalp; the chance of primary adhesion taking place, to some extent, is not improbable, and it may be solicited with good prospect of success. Accordingly, in the first instance, the treatment is the same as for an incised wound. Foreign bodies, such as grit, portions of clothing, having been removed by a wet sponge or stream of water; replacement of the torn textures and their retention in position by the usual surgical appliances, are the immediate rules of treatment to be observed. The unknown power and resources of this or that mode of reparation, in different parts of the body and in different individuals, will ever restrain the pathological Surgeon from hastily foregoing the probability or possibility of the more advantageous mode in *any* case. But the disintegrated textures inevitably die, to a greater or less extent. Hence the kind and amount of assistance required. In the event of primary adhesion having failed entirely, and in all *deep* and *extensively* contused wounds, it becomes necessary to actually encourage and aid the process of sloughing, in order to bring into operation that of healing by granulation. The separation of sloughs is favoured by warmth and moisture, in the shape of a light poultice or spongio-piline epithem. The reparative process needs little assistance; position, rest, and protection from the action of the air by carbolic acid dressing, will suffice for the granulating of any healthy wound.

*Deep and extensively* contused or lacerated wounds of either *limb* are conditions which, in relation to profuse suppuration or gangrene, must be considered both with regard to the preservation of the limb and the life.

*Amputation.*—The propriety of amputation has regard to both these issues, which will be more advantageously considered in connexion with compound fracture and dislocation. If gangrene be allowed to *supervene*, life is endangered; if the *limb* be removed *before* the supervention of gangrene, it may have been sacrificed by such untimely interference.

The compromise of these two considerations is better determined by pathology than by empirical experience:—

(1) If the *whole substance* of a limb be involved by the injury, gangrene is inevitable; amputation, therefore, is imperative to intercept this event, and thus preserve *life*. (2) If, however, the injury be less extensive, and gangrene not inevitable; what then? Various pathologico-anatomical conditions—less than the whole substance of a limb being involved—are defined in surgical works; respecting which forms of injury, experience is said to justify amputation, in the first instance, considering the probable supervention of gangrene. But this event can never be foretold with absolute certainty in different conditions of injury; the resources of reparation and the reserve constitutional power of different individuals being *unknown*. Having regard, therefore, to the preservation of the *limb*—in cases short of its irreparable destruction—the *actual supervention* of gangrene is the only ground of assurance as to the urgent necessity for amputation.

This compromise between limb and life may be thus stated:—whenver a limb is destroyed, by injury, and life would be perilled by gangrene supervening, (primary) amputation is imperative; whenever a limb is not entirely destroyed, the *rule* should be, to give the limb *its* chance of recovery, by waiting for gangrene; but in that event (secondary) amputation becomes necessary, and further delay would peril life, without the compensating probability or possibility of preserving the limb. Duly weighing both these conditions; the Surgeon will ever be prepared to estimate the urgency of amputation in any particular form of contused or lacerated wound—and otherwise than when destructive of the whole substance of a limb.

The subordinate conditions of injury, necessitating amputation, are thus enumerated in Mr. Erichsen's work on Surgery. It should be observed that some of them are, not conditions of contused or lacerated wound alone, but as associated with Fracture, compound.

(1) If the soft parts be extensively stripped away from the bones, though these be entire, so much sloughing and suppuration would ensue as to leave a useless limb, and amputation should be performed.

(2) If a large artery, as the femoral, is lacerated at the same time that the soft parts are extensively injured, and the bone fractured, amputation is required in order to prevent the occurrence of gangrene.

(3) If the knee be largely opened, with laceration of the soft parts, and perhaps fracture of the contiguous bones, the limb must be amputated. Corresponding injuries of the ankle, shoulder, and elbow joints, may admit of resection rather than of amputation.

(4) Bad crushes of the foot have a great tendency to run into gangrene, and hence require amputation. In the hand, on the contrary, very extensive injuries are often recovered from, without this operation being necessary; and in many cases partial resection may be substituted for it.

The *time* also, as well as the conditions, for the performance of amputation is equally represented by the foregoing rules. Amputation for injury, in general, is commonly divided into Primary and Secondary;



the *primary* being that which is performed during the first twenty-four or thirty hours, before any inflammation has commenced; the *secondary* being amputation performed after that period, or at least before the supervention of inflammation and suppuration. Amputations performed in the intervening period, between twenty-four hours and inflammation, are sometimes designated *intermediate*. With regard to contused and lacerated wounds; the proper *time* for amputation under different circumstances, is expressed by these terms—primary and secondary, as having reference to the performance of the operation before or after the occurrence of gangrene; in accordance with the rules already laid down.

*Part for Amputation.*—In the event of *gangrene*, the *seat* of amputation or the portion of limb to be removed, should not be determined by waiting for the formation of the line of demarcation between the living and dead parts. Amputation must be performed at once, and sufficiently high above the seat of injury to prevent the recurrence of gangrene in the stump. The foregoing considerations relate exclusively to purely traumatic gangrene. *Spreading* traumatic gangrene being the local manifestation of some morbid condition of the blood, its supervention is so far less likely to be intercepted by the primary amputation of the injured part. On the other hand, gangrene appearing in the stump, would frustrate the intention of the operation with regard to the preservation of life. When spreading gangrene has supervened, the Surgeon is placed in this dilemma in regard to the part for amputation:—if the operation be performed without waiting for the line of demarcation, gangrene will probably reappear in the stump and death ensue; if the operation be postponed, for this purpose, the gangrene spreads rapidly up to the trunk, and then death is inevitable. Considering that the injury is the exciting cause of this gangrene, amputation had better be performed at once, and at some height above the apparent seat of injury. But, in selecting a sound part of the limb, and not merely that which may recover itself as a stump; it must ever be remembered, that while the damage done by contusion or laceration is more extensive than may appear on the surface, the destruction wrought by spreading gangrene, especially in the cellular texture, has even a wider range up the limb, than as declared by any discoloration of the skin. The safest parts for amputation are, probably, at the shoulder joint, when the arm is involved; and in the upper third of the thigh, when the leg is affected as far as the knee.

The *after* or *constitutional* treatment is fully considered in connexion with the *general* pathology of Gangrene.

**PUNCTURED WOUNDS.**—*Structural condition.*—A Punctured Wound is a more or less contused and lacerated wound; varying in *depth*, but of greater extent in this direction than superficially. Structures may thus be injured far beyond what appears to be the extent of injury, by the aperture in the integuments. Other kinds of Wound—the incised and the purely contused or lacerated—may indeed be *complicated* by their depth; a punctured wound is characterized by this additional element. Thence, penetration of an artery and the formation of traumatic aneurism, may complicate a punctured wound in any part. Penetration of the brain complicates a punctured wound of the skull; and similar injury of the lung or heart, or of one or more of the abdominal viscera, may complicate a punctured wound of the thoracic or abdominal cavities, respectively.

The *external characters* of a punctured wound are comparatively unim-

portant, and not characteristic. Varying in size, from a pin's point to a bayonet-thrust or an aperture of larger size; its shape differs with the form of the penetrating instrument; the margin of the aperture is irregular and the surrounding integument bruised, if the wound was produced by the penetration of a blunt-pointed instrument; and this laceration and contusion are the more conspicuous if the weapon was of increasing size from the point upwards, as a bayonet. The hæmorrhage cannot be estimated by the quantity of blood which escapes externally. The narrow track of a punctured wound and laceration of the textures, rather impede the escape of blood, and are favourable to the formation of traumatic aneurism. If the wound extend into an internal cavity, as the thorax, hæmorrhage may take place yet more abundantly without a corresponding escape of blood from the aperture externally.

The Symptoms connected with the penetration of *particular parts*, perchance the viscera, are specially significant, in virtue of the function of the part which is thus involved; but, as not pertaining to the general pathology of Punctured Wound, such symptoms are here omitted. Each successive injury, in depth, is less open to detection, owing to the narrow track of the wound. The *diagnosis*, therefore, must be determined by *functional* symptoms; and it will be remembered that structures of vital importance, possibly, may be implicated, beyond the otherwise apparently simple puncture, viewed externally.

*Causes, and Effects of Punctured Wound.*—Any pointed instrument, sharp or blunt-pointed—*e.g.*, a pin, an old rusty nail, a pen-knife, or a bayonet—represents the whole class of causative agents. Contusion and laceration are proportionate to the bluntness of the penetrating instrument. The *constitutional* effect of a punctured wound, consists partly, of syncope due to hæmorrhage; partly and perhaps principally, of shock to the nervous system; and here again, both are generally disproportionate to the apparent importance of the local lesion, which, by its depth may involve large blood-vessels and nerves, and possibly implicate a vital organ. Tetanus is another constitutional condition not unlikely to occur.

*Course.*—Sloughing ensues, more or less in extent, along the track of the wound, accompanied with suppurative discharge; but, eventually, it heals by granulation. If the textures are not much contused nor lacerated, the wound may heal by primary adhesion; and this, although the depth of penetration may have been considerable, extending even into a great cavity and involving an important organ. Thus, in one case, under my observation, after a stab in the back with a fork, which entered the lung; union of the flesh-wound speedily ensued, and the lung-symptoms also subsided. In another case, after a similar stab in the loins, penetrating the kidney; this mode of healing occurred, and the hæmaturia disappeared. Other remarkable cases are on record [P. pp. 154 and 766]. Apart from this general vital history, a punctured wound extending into any internal organ, exhibits a series of phenomena peculiar to the particular organ implicated; and thence the completion of the vital history of this form of injury, as occurring in different parts of the body, belongs to Special Pathology.

*Prognosis.*—The prognosis of Punctured Wound is partly analogous to that of any other contused or lacerated wound. It is unfavourable in so far as the kind of structural *disorganization* is that of contusion or laceration. Sloughing and suppuration to some extent are almost inevitable. The presence of any *foreign body* in the wound has a

similar influence. But the prognosis is specially unfavourable according to the *depth* of the wound, or the number and functional importance of the parts implicated, as complications of the wound. Injury to large blood-vessels, nerves, or an internal organ, are thus, severally, unfavourable conditions; and proportionately to the importance of the functional disturbances thence arising.

The subsequent course of a punctured wound, in its undergoing reparation by suppurative granulation, is an *eventually favourable* ground of prognosis.

*Treatment.*—The first indication is to arrest hæmorrhage, which obviously claims immediate attention when it occurs in any considerable quantity. Pressure, by means of a compress, will generally prove sufficient, unless a large artery be punctured, when it will be necessary to ligature the vessel above and below the aperture, by cutting down in the track of the wound, if it can possibly be thus secured. The removal of any foreign body is another obvious indication, whenever it can be safely fulfilled. A portion of clothing may have been thrust so deeply into the wound, and possibly into some internal organ, that its presence cannot be ascertained with certainty, nor its removal effected with safety, and without unwarrantable mutilation.

Guided by the processes of reparation, healing by primary adhesion should be *attempted* in all cases; but the prospect of success will depend on the comparatively simple character of the wound, by the less circumferential contusion, the absence or removal of any foreign body, and the arrest of hæmorrhage. Failing in most cases to induce adhesion, the process of suppurative granulation is the alternative to be solicited, as in the usual treatment of a contused or lacerated wound.

## CHAPTER XVI.

### GUNSHOT WOUNDS.

**GUNSHOT WOUNDS.**—*Structural Condition.*—Of Complicated Injuries, none are more interesting and important than Gunshot Wounds. But they chiefly concern the Military Surgeon, although the general Surgeon may occasionally be called upon to undertake the charge of such injuries in civil practice. It will, therefore, be doubly necessary to fully consider the guiding elements of their pathology and treatment.

Gunshot wound is, essentially, a contused and lacerated wound; but varying in *extent* and *depth*. The latter element is always a critical consideration. Structures may thus be injured far beyond what appears to be the extent of injury, in connexion with the aperture or apertures in the integuments. If any part, as a limb, be shot away entirely, as by a cannon-ball, the extent of injury is more openly declared. Other kinds of wound—the incised, and the purely contused or lacerated—may, indeed, be thus *complicated*; a gunshot wound is characterized by either additional element. Thus, penetration of an artery, with the formation of traumatic aneurism, may complicate a gunshot wound in any part. Penetration of the brain complicates a gunshot wound of the skull; and similar injury of the lung or heart, or of one or more of the abdominal viscera, complicates a gunshot wound of the thoracic or



abdominal cavities respectively. Compound Fracture or Compound Dislocation not unfrequently complicate the more severe forms of Gunshot injury.

The *course* of a ball in the body is determined by its shape and velocity. The round musket-ball—formerly in use exclusively, and propelled with a velocity which scarcely reached eighty yards, revolving, also, on its axis at right angles to its transit—was turned aside by the slightest obstacle. On striking the body, the resistance offered by clothing, or, on penetrating the skin, by a bone, and, indeed, the different resisting media of different structures, would deflect the ball from its course, and make it assume a circuitous and perchance most extraordinary route; ultimately lodging in the body in many cases. Various remarkable examples are recorded by authors on gunshot wounds.\* Nowadays, the cylindro-conoidal rifle-bullet, generally used, and propelled with a velocity true at 1000 yards or more, pursues its course straight through the body, and out again, in most cases. An apparent deviation is sometimes due to the Surgeon omitting to view the patient in the position he was when the ball entered; and, occasionally, though rarely, a real deviation, possibly a circuitous course, is caused by an accidental concurrence of circumstances, especially when the velocity of a conoidal bullet has become diminished.

Of the various *textures*, none suffer so much damage as bone by the penetration of a conoidal bullet. Piercing and passing through the soft parts, it splits and comminutes any bone in its way, producing fissures which extend into neighbouring joints; the greater destructiveness of this shaped projectile, resulting from its wedge-like action, and the peculiar resistance offered by the osseous texture. The bullet itself becomes somewhat changed in shape; its apex being flattened and reverted, if it strikes point-blank; or planed from its apex towards its base when it strikes parallel to its line of flight.

*Foreign bodies*, of various kinds, are often lodged in a gunshot wound, and not unfrequently lie deeply buried; thus constituting another complication.

The *lodgment* of any foreign body is determined by its shape and velocity, chiefly by the latter circumstance. A conoidal ball, with a considerably reduced speed before entering the body, will lodge, more or less deeply; while a round ball, although at full speed, having taken a circuitous route in the body, may become expended, and thus effect a lodgment. Bullets scattered from canister or spherical case, are liable to lodge; owing, apparently, to disturbance of their course in the primary discharge, and secondarily, by explosion of their containing case. (Longmore.) Grape-shot lodge occasionally, and possibly after a very devious course, in the body. More rarely, a cannon-ball lodges, and remains concealed. A ball weighing 8 lbs. was buried in the thigh, and discovered only by amputation. (Guthrie.) In another case, a ball weighing 5 lbs. was found also in the thigh by amputation. (Larrey.) Penetrating fragments of shell, if projected edgeways, almost invariably lodge, and are frequently concealed; of which some remarkable instances are mentioned by Mr. Longmore.†

In exceptional cases, a *small scale* may be detached from a leaden bullet, and this lodges in the wound. Such portions may occur,

\* System of Surgery, 1861, ed. by T. Holmes, art. by T. Longmore.

† Op. cit. p. 15.

irrespective of the shape of the bullet, from a cylindro-conical as well as from a round bullet; and instances of either kind came within the experience of the last-named authority during the Crimean war.

Other *kinds* of foreign bodies, and of various shape, as gravel, bits of wood, portions of clothing, &c., are not unfrequently found, or remain deep in a gunshot wound; any such substance being additional to the projectile, or the only extraneous substance.

A portion of the body of another individual close at hand, may be struck off by gunshot injury and driven into the one who is the subject of examination. Any such fragment is thus introduced by *indirect* participation in the gunshot injury. A double tooth, belonging to a comrade was found embedded in the eyeball, in one case; a portion of the jaw of a companion was driven into the palate in another case; while, in a third case a piece of the skull was found impacted between the eyelids, the fragment having been shot off the skull of a soldier close by. And, generally speaking, the fragment thus introduced comes from a corresponding region of the body struck by the shot. (Longmore.)

*Signs.*—The external appearances produced by gunshot wound, will depend on the size of the projectile and its velocity.

*Number of Apertures.*—A small penetrating body, as a bullet, produces;—(a) An aperture of *entrance*, and, if the ball lodges, this is the only aperture. But, the ball may have passed round and out at this aperture; or, it may have rebounded owing to the elasticity of the part struck, as the cartilages of the ribs;\* or, having lodged temporarily, it may have been withdrawn in a pouch of clothing.† There being only *one* aperture is, therefore, no *sure* sign that the ball has *lodged*. (b) *Two* openings—one of *entrance*, another of *exit*—are produced if the ball penetrates with sufficient velocity to pass through the limb or body. (c) More than one, perhaps *several* openings of *entrance* are produced occasionally. Thus, a bullet having first struck any hard resisting object, and split into pieces, two or more portions may recoil and wound a bystander; producing as many entrance-apertures. In one such instance, a ball split into five pieces by first striking against a rock; and all five portions entered the body of a soldier a few paces off. But, the number of openings are not necessarily the same as that of the balls which *penetrate*. For example, of three balls, two may have the same aperture of entrance, and of exit also. This coincidence happened in the case of a youth who was shot through the abdomen; “that *three* balls went through him was evident, for they afterwards made three holes in the wainscot behind, but two very near each other.” (Hunter.) (d) More than one, perhaps *several* openings of *exit* are formed in some cases. Thus, a bullet having struck a ridge of bone and *split* into pieces, two or more portions may pass through; producing as many exit-apertures. In one instance, a ball having split into two pieces by striking against the sharp crest of the right tibia; both portions passed through the calf of that limb, forming two openings of exit, and then severally entering the other calf, produced five openings altogether.‡ A portion or portions of a *split* ball may *lodge*. Instances of this kind are recorded, where the ball had struck the edge of the patella, or the spine of the scapula.§ In like manner, when several *balls*, say three, have entered; one or more may *lodge*. There being an aperture of *exit* is, therefore, no *sure* indica-

\* Guthrie, ed. ii. p. 19.

† Dupuytren, *ibid.* p. 428.

‡ Clin.-Chir. Dupuytren, t. ii. p. 426.

§ Obs. in Milit. Hosp. in Belgium, J. Thomson.

tion that one or more balls, or a portion of one, has *not* lodged; unless, in the latter case, the entire ball can be found. And, moreover, the *number* of exit-apertures are not necessarily the same as that of the balls which entered, or of the portions into which any one ball may have split. (e) *Several* openings, both of *entrance* and of *exit*, may be produced, and by a *single* ball. In one case, a ball passed through the hand, then the skin of the groin, and next the left buttock; thus causing six openings.\* In another case, six openings also were caused by a single ball having passed through both thighs and the scrotum. (Guthrie.)

*Appearances of the Entrance and Exit Apertures respectively.*—They are tolerably distinctive. (Fig. 45.) The aperture of *entrance* is a small, nearly circular opening, its margin inverted, slightly torn, and surrounded with an areola of purple ecchymosis. The aperture of *exit*, is larger and more irregular, its margin everted and more lacerated, showing the subcutaneous fat, and with less surrounding ecchymosis. These differential characters depend chiefly on the diminished velocity of the ball after its passage through the substance of a limb or the body. Consequently, the appearances of the entrance-opening vary somewhat in different cases, chiefly according to the speed of the ball; and its characters may re-

FIG. 45.



semble those of the exit-aperture. A larger penetrating body than a bullet, and one of an irregular form, as a small piece of shell, produces an opening similar to that of a bullet; but it is more lacerated and less circular, of small size also as compared with the fragment, this peculiarity resulting from the slanting direction in which it penetrates. Generally there is no exit-aperture; such a projectile lodges, owing to its comparatively less momentum. A still larger penetrating body and of an irregular shape, as a larger fragment of shell, produces an aperture yet more lacerated, and of even smaller size as compared with the fragment. It also not unfrequently lodges.

A large-sized projectile, as a *cannon-ball*, may penetrate and pass through the body, producing an entrance- and an exit-aperture, which

\* Hist. Chir. du Siège d'Anvers, Hippolyte Larrey, 1833.



respectively resemble those caused by a smaller projectile, as a bullet ; only that the characters of either aperture are presented on a much larger scale. If, however, such a projectile as a cannon-ball strikes one of the extremities, it carries away the entire limb, as if transversely amputated ; leaving a contused stump, purple and pulplified. The stump is less abruptly truncated and more lacerated, if the ball impinge with diminished velocity, as when bounding along the ground it strikes off a limb. In both these forms of cannon-shot injury, the ball impinges in a direct line. If a cannon-ball strikes the body in a *slanting* direction, thus brushing the surface, and especially if when moving with a greatly diminished velocity, it rolls over the part ; in either case, the skin may not be broken, its elasticity apparently preserving that texture entire, and scarcely any discoloration marks the course of the ball. But the gravest subcutaneous disorganization of other textures is produced ; even to the pounding of muscles, vessels, nerves, and bone, or of the viscera. Such internal lesions, unaccompanied by any corresponding external signs, were formerly known as “wind-contusions,” and attributed by French authors, to the “vent de boulet.”

*Hæmorrhage* of an arterial character, may attend a gunshot wound ; and sometimes proves fatal almost instantaneously. A gush of arterial blood is seen, and then and there a pallid corpse. Generally, however, the accompanying laceration secures the vessel, as already described (Chapter XIV.), and prevents the escape of any considerable quantity of blood, at the time of injury. Puncture by a spiculum of bone, occasionally, will cause primary hæmorrhage ; but a bullet may pass between an artery and vein in contact, as the femoral vessels, without opening either vessel ; their elasticity apparently preserving them intact.

The *pain* of a gunshot wound is worthy of notice as a symptom. In the first instance, it is either like the sharp stroke of a cane, or a dull heavy blow ; differences due, perhaps, to the degree of contusion. The pain may be referred to a part remote, more or less, from the seat of injury. This want of localization, coupled with the inconstant and indefinite character of the pain itself, evinces its inferior *diagnostic* value as a symptom, compared with the signs already described. For a short time after the injury, the sensibility of the part is numbed ; pain succeeding, and with increasing intensity as inflammation and tension supervene.

The symptoms connected with the penetration of *particular parts*—perchance the viscera—are specially significant, in virtue of the function of the part, which is thus injured ; but, not pertaining to the general pathology of gunshot wounds, they are here omitted.

*Causes ; or kinds of Projectiles in Gunshot Wounds, and the Effects of these Injuries.*—The *shape* of projectiles used in warfare presents several varieties, the chief of which are—spherical, as cannon-balls, grape, musket-shot, and shell ; cylindro-conoidal, as balls belonging to rifled cannon and rifled muskets ; irregular, but generally bounded by linear and jagged edges, as fragments of shells and splinters. (Longmore.) In point of *size*, projectiles vary from a rifle bullet to the largest sized cannon-ball or shell. The material and *density* of projectiles are less various ; being either lead, as the common bullet, glass, as some hand-grenades, or cast iron, as cannon-ball or shell and all other missiles.

The *momentum* of a projectile is represented by its weight and velocity. The *velocity* of different kinds of projectiles varies considerably. Accord-

ing to a table published in 1851, the common musket-bullet moves at the rate of 850 miles per hour, the rifle-ball, of that date, at 1000, and the 24lb. cannon ball at 1600 miles per hour. But the musket-ball then could not be depended on to hit an object beyond 80 yards, and the rifle not further than 200 to 250 yards; while the present Enfield rifle is sighted to 900 yards, and the short Enfield to 1100 yards. (Longmore.)

The *kind of motion* imparted to different projectiles and thence their course through the air, is a difficult question, which can only be analysed and determined mathematically, and is in fact a very important branch of dynamics. Different kinds of motion have to be considered in combination, and as resulting from the propulsive force, subject to the law of gravity. A ball discharged from the old smooth-bore musket, has a double motion; it revolves on its axis at a right angle to the line of flight. A ball discharged from a rifle-bored musket or rifle, has also a double motion, but of a different kind; it revolves on its axis in the line of flight. The *angle* at which a projectile strikes may be said to be accidental in many or most cases, and unconnected with the missile itself or its motion. Striking frequently at or nearly a right-angle; one kind of missile—the shell—exploding on the ground, scatters its fragments upwards, and thus any such fragment will strike probably at an acute or obtuse angle.

The *penetrating* power of a projectile is determined mainly by its shape and velocity. The cylindro-conoidal form is very penetrating, in virtue of its mechanical advantage as a wedge. Thus, supposing one of the old musket bullets to strike a limb—at eighty yards, and an Enfield rifle conical bullet of the same weight at eight hundred yards; the rate of velocity being equal in either case, the injury from the latter *shaped* ball may be expected to be much greater than that from the former. (Longmore.) The influence of *velocity* is well known, and shown by the different effects of the same kind of missile according to its speed. A spent cannon-ball, rolling or bounding along the ground—ricochetting, may carry away a limb; whereas the same ball at full speed would level a line of men. But the former injury, occurring possibly when the cannon-ball is rolling along so slowly, as apparently to have no more force than a cricket-ball, shows also the influence of *weight* as an element of the momentum. *Density* is an important consideration respecting the power of penetration. For example, in the two most perfect of modern English rifles, the Enfield and the Whitworth—the projectiles and charges being of the same weight—when lead is used, the penetration at eight hundred yards is one-third greater from the Whitworth than the Enfield; but, if a less yielding material be used, as when lead is mixed with tin, its penetration is as 17 to 4, at eight hundred yards. (Longmore.) The *kind of motion* has certainly some relation to the penetrating power of any projectile. If spinning, like a top, at a right angle to the line of flight, as a bullet discharged from the old smooth-bored musket; the projectile is easily turned aside from its course; whereas, the screw-motion of a ball, discharged from a rifle-bored tube, coinciding with the line of flight, is very penetrating. Lastly, the *angle* at which a projectile strikes, must affect its penetration. A right angle will be more effectual than an acute or obtuse angle; the impinging body having a tendency to glance off in striking at the latter angle. Other bodies are sometimes associated with projectiles as *indirectly* causing wounds, additional, perhaps, to gunshot

injury. Such missiles may be stones, splinters of wood or bits of iron from gun-carriages, portions of clothing or coins, and fragments of bone from a wounded comrade. Having borrowed their motion from the projectile itself, of whatever kind—perhaps a ball already spent—any such body strikes with a proportionately diminished impetus, and with different degrees of effect under various circumstances affecting its own displacement, shape, and so forth.

The *effects* of a gunshot wound *locally*, and *constitutionally* are quite *analogous* to those of a punctured wound, or of any contused and lacerated wound. Parts are damaged far beyond the apparent extent of injury. Thus, the textures are killed to a greater or less extent along the track of the wound, and a corresponding tubular slough is eventually formed. Shock, rather than syncope from sudden hæmorrhage, is the primary constitutional disturbance. This sloughing is more extensive and the shock more overwhelming and prolonged, when caused by projectiles of modern design; their more deadly character being due to their greater power of penetration.

Considerable importance has been attached to shock, in the sense of *concussion* of the whole body, by a heavy projectile, as a cannon-ball. But this can only occur when the velocity of any such projectile is so much reduced as to give time, in striking, to overcome the inertia of rest in the body. A cannon-ball at full speed may carry away a limb without knocking down the individual, who falls simply by the sudden shock of injury to the nervous system. Tetanus is of common occurrence. But its frequency has varied much in different campaigns, and under different climatic influences. In the Peninsular War, it was estimated to occur in about 1 case in every 200 wounded; in the Schleswig-Holstein War, 1 in about 350 cases. In the Crimea, tetanus appears to have been of rare occurrence. Alcock's estimate of 1 to every 79 wounded is too high. After naval engagements, the mortality has often been high. Sir G. Blane states that, after Rodney's action, out of 810 wounded 20 were attacked with tetanus, being 1 in 40. But sudden change from heat to cold is the most frequent cause of tetanus among the wounded. This was observed after the battles of Moskowa, Bautzen, Dresden, Chilianwallah, and Ferozepore. The above statistics include the proportion of cases of tetanus arising from all kinds of wounds, besides gunshot.

*Consequences.*—The vital career of a gunshot wound, is analogous to a punctured wound, or of any contused and lacerated wound. *Gangrenous inflammation* invariably supervenes, perhaps extensively, along the track of the wound; and thus textures which may not have been killed more immediately, die subsequently. The *total* result is represented by the slough which forms. About the fifth day of a gunshot wound, this slough begins to loosen from the margin of either aperture, if two exist, and the line of demarcation between the living and dead tissues is clearly visible; about the tenth day, the slough or sloughs may be seen hanging out of the openings, and come away in the dressings. A tubular casting of slough had hitherto intervened between the living tissues surrounding the course of the wound and prevented its union by adhesion. Suppurative granulations supervene, and the wound heals, or should heal, from within outwards.

Pending this process of reparation, tension is often extreme and extensive, and suppuration equally profuse and diffused. *Secondary*



hæmorrhage is not an uncommon event. It occurs most frequently on the sixth day. (Baudens.) Arteries which did not bleed primarily, or which were only slightly grazed, may now burst forth. Such hæmorrhage, if not suddenly fatal, may be uncontrollable, from its depth or in a disorganized part, or ultimately fatal in an individual already reduced by suppurative discharge.

An *unextracted ball* plays a singular part in the subsequent history of a gunshot wound. Constant suppuration, and exfoliation if the ball be lodged in bone, are events which might be expected. But the ball may move from its first lodgment, and travel to some distance, in a devious course, and ultimately find an exit or still remain in the body. Various functional disturbances arise during these peregrinations. Again, the ball may become encysted in dense fibro-cellular tissue, and then being stationary and isolated in a sac, it occasions little or no inconvenience. Or, a long canal-like cyst may form, in which the ball, although imprisoned, moves freely up and down. Apart from this general vital history, a gunshot wound extending into any internal organ, exhibits a series of phenomena peculiar to the particular organ implicated; and thence the completion of the vital history of this form of injury, as occurring in different parts of the body, belongs to Special Pathology.

*Prognosis.*—The prognosis of Gunshot Wound is partly analogous to that of any other contused or lacerated wound. The kind of structural *disorganization* is important; as leading inevitably to sloughing and supuration. The presence of any *foreign body* in the wound has a similar influence. But the *extent* and the *depth* of a gunshot wound, will much affect the issue. The prognosis is specially unfavourable according to the number and functional importance of the parts injured, as complications of the wound. Injury to large blood-vessels, nerves, or an internal organ, are thus, severally, unfavourable conditions; and proportionately to the functional disturbances thence arising. Compound Fracture, and Compound Dislocation, are obviously most serious complications of gunshot injury.

The subsequent course of the wound in its undergoing reparation by suppurative granulations, is an *eventually favourable* ground of prognosis.

*Treatment.*—*Immediately* after a gunshot wound, certain requirements demand instant attention, as to hæmorrhage, position, and shock.

1. Arterial hæmorrhage, whether in the form of a jetting stream or a rapid dripping of blood, must be arrested forthwith. Abundant venous hæmorrhage is scarcely less perilous. If a limb be the seat of injury, a tourniquet should be applied, so as to command the main vessels. The same rule holds good when the limb is struck off, as by a cannon-ball; a tourniquet should be applied above the stump. In the absence of this instrument, a substitute may be readily made, by means of a stone about the size of an egg, rolled in the middle of a pocket-handkerchief and placed over the main artery; the ends of the handkerchief being drawn around the limb and secured in a knot, and then twisted up tightly with a piece of stick or the hilt of a sword passed under it. A compress and an elevated position of the limb, are more suitable when the hæmorrhage is purely venous. The part may be covered with cold wet lint, as a soothing application. If the head or neck be wounded, hæmorrhage, whether arterial or venous, must be arrested by pressure; and cold applied.

2. Attention to *position* is important. A limb should be laid in an

easy position; and fixed during the removal of the wounded person to Hospital, in order to prevent any disturbance of the injured part from shaking or from spasmodic action of the muscles. This precaution will be the more necessary when compound fracture or dislocation complicates the injury. If the chest be shot through; the patient should be laid on the injured side, and cold applied. If emphysema occur, or if air escape freely through the wound, a broad rib-roller should be applied. If the abdomen be wounded, the patient should be laid on the injured side; or, if the wound be central, on his back, with the knees drawn up over a pillow or knapsack. Any portion of protruding intestine or other viscera, must be gently cleansed with water and at once returned.

3. *Shock*, or sometimes *hæmorrhagic collapse*, may be most perilous; and brandy, wine, or other stimulant, must be administered to preserve life. Cold water may be given freely to allay the parching thirst which speedily ensues from loss of blood.

The *subsequent* indications of treatment comprise—the permanent arrest of hæmorrhage.—Extraction of foreign bodies.—The management of inflammation, and sloughing; and—the conditions requiring amputation.

4. *Hæmorrhage*.—The permanent arrest of hæmorrhage may first demand attention. If arterial, the application of a double ligature to the wounded vessel may be necessary; the wound being sufficiently enlarged perhaps by an incision for this purpose. But it is seldom requisite to have recourse to ligature for primary hæmorrhage after gunshot injury. When a limb is torn off, leaving a stump, the lacerated vessels soon cease to bleed. Venous hæmorrhage must still be arrested by pressure, and elevation of the limb.

Other indications for interference with the wound are best determined by examining the patient in the position, as nearly as it can be ascertained, in which he was relatively to the projectile that struck him. In any other posture, the apparent course of the ball in the body, and thence also the probable extent of injury or the parts implicated, would be modified by muscular action and by the various degrees of elastic retraction of the wounded textures.

5. *Foreign bodies*.—To detect any such substance, the finger is the best searcher or probe. In case of doubt or difficulty of examination as to the lodgment of a *lead*en bullet, Nélaton's probe offers the requisite facility and certainty of diagnosis. In the well-known instance of Garibaldi, it will be remembered that a ball was detected with this instrument by Nélaton, after search had been otherwise made, repeatedly in vain.

*Enlargement of the Entrance Aperture*.—A slight incision is sometimes absolutely necessary for the removal of a *bullet* or other foreign body; but the rule of practice which formerly prevailed of invariably enlarging the aperture by incision and to some considerable extent was an error; suggested by the false pathology of thus converting a supposed "poisoned" wound into a simple incised wound, and of giving free vent to the noxious discharge. Any foreign body, of *irregular* shape,—*e.g.*, a fragment of shell, more generally needs release to effect its dislodgment and extraction; the circumstances in this case at once showing the necessity, and regulating the extent, of incision. But unless for an obvious purpose, the *rule* should be to avoid making any enlargement of a gunshot wound, any extension of the original injury.

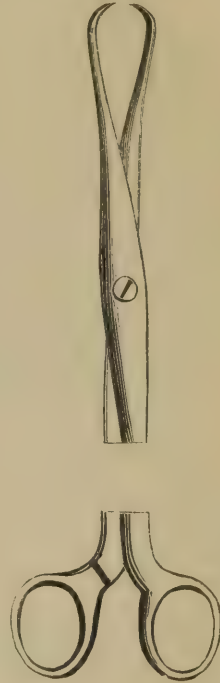
To remove a bullet some form of bullet-extractor is generally requisite or advantageous. The most convenient form is here represented. (Fig. 46.) Any kind of forceps is somewhat objectionable, owing to the dilatation of the textures in using the instrument. A bullet lodged in bone is, perhaps, most readily extracted by an elevator, aided by gouging away any overhanging portion of bone. Any other foreign body, as a portion of clothing, which might be mistaken for some natural texture, should be searched for with the finger and removed by manipulation rather than with forceps, which are apt to seize both indiscriminately. Examination of the dress will probably show whether a portion was carried with the shot into the wound. It should, however, be remembered that any such fragment may have been withdrawn in undressing the patient. Foreign bodies are *eligible* for removal, according to the patency of their situation, as their presence can then be ascertained with proportionate certainty; but the relation of surrounding parts will affect the *safety* of an operation for extraction. Thus, when situated beneath the skin, although perhaps at some distance from the entrance-aperture; a bullet is readily detected and removed by an incision, care being taken to steady the ball lest it slip away out of reach. On the other hand, when the foreign body is situated deeply, and possibly already out of reach; its detection is less certain, unless a leaden bullet, by Nélaton's probe, and its extraction, in any case, by operation, is less safely accomplished. If, therefore, the body so placed, cannot be distinctly localized, or should it be inaccessible surgically, or both; the rule of practice suggested, is to abandon any further research, as well as any attempt at operative interference. This injunction becomes absolute in the case of a foreign body lodged in any internal organ.

An ordinary gunshot wound, presenting one or two, possibly more, openings, with an intermediate line of texture about to slough, is a kind of lesion which requires little or no external *dressing*. The apertures may be protected from exposure to dirt by corresponding pieces of wet lint; but any *restrictive* dressings which would preclude the escape of sloughs and the discharge of pus, are altogether at variance with the suggestions of pathology. An irregular and lacerated wound, externally, as by a piece of shell, may need such dressings to readjust and retain the textures in *position*.

6. The accompanying *inflammation* and tension with severe pain, are perhaps best moderated by warm water fomentations; but the choice of warm or cold and evaporating applications, must be guided by experience and trial in each case, rather than by any pathological considera-

\* This bullet extractor was used most successfully in the Franco-German war. An American invention, adopted by Weiss.

FIG. 46.\*





tion at present known. *Early and free incisions* may be requisite to relieve tension and thence the accompanying constitutional disturbance, and to give free vent to matter which otherwise accumulating would burrow and disorganize the part. This relief of tension will also limit the sloughing. Subsequently, the process of healing by granulation and cicatrization, guides and regulates whatever slight assistance may then be necessary on behalf of reparation.

Of the *untoward* events to which a gunshot wound, in general, is liable; *secondary* hæmorrhage is one. It is especially apt to occur when the sloughs loosen and separate—about the fifth or sixth day. At that time, therefore, the application of a tourniquet around the limb, in readiness to be tightened at a moment's notice, will always be a judicious precaution, but only as a temporary measure to arrest the hæmorrhage. Ligature of the bleeding vessel or vessels is imperative, and without delay. This should be done *in situ*, if possible; or when impracticable, then by ligaturing the main trunk; or *that* failing to command the hæmorrhage, amputation is the only resource. The probability of *gangrene* supervening, and thence the propriety of amputation; and the question whether it should be primary or secondary, are subject to the same or analogous considerations as with regard to contused and lacerated wound, and to compound fracture or dislocation.

7. *Amputation*.—The following *conditions* are said to require amputation; and with destruction of the whole substance of a limb, there can be no question as to the propriety of primary amputation:—

(1) If the limb be completely crushed and disorganized, whether by a direct blow or by wind contusion, though still left adherent; or, if the principal vessels and soft parts be carried away, though the bone be uninjured; or when the whole limb is carried off, a ragged stump merely being left.

(2) In some of the more serious injuries of the lower extremity, amputation is especially necessary. Thus, if a bullet divide the femoral vessels, or the sciatic nerve, and splinter the thigh bone; or if the sciatic nerve and soft parts at the back of the thigh be carried away, although the vessels and bone be left uninjured; and generally, all compound fractures of the lower part of the thigh. Amputation of the upper two-thirds of the thigh, for gunshot injury, is generally fatal. On the other hand, such injuries rarely *recover*. *Six* cases, however, and in the upper third, are reported to have occurred during the Crimean war. (Longmore.)

(3) Gunshot fracture of the bones of the leg, if the tibial arteries be injured, or if the knee or ankle-joint be wounded. In the middle of the leg, and if there be no longitudinal fissuring of the bone into either joint; the removal of splinters of bone may suffice.

(4) Gunshot wound of the foot, extending into the tarsus, requires amputation at or above the ankle; while analogous injury of the hand, often allows some operation of partial removal, reparation being more active in the hand than in the foot. Thus, three or four fingers with, perhaps, their metacarpal bones may be amputated, and a remnant-hand or thumb-hook be preserved.

(5) In gunshot injuries of joints; those of the upper extremity do not generally demand primary amputation; those of the lower extremity are more urgent. If the head, neck, or trochanters of the femur be splintered into the articulation by a bullet wound; death with or without

amputation, at the hip-joint, is about equally inevitable. *Excision*—as also in some cases of compound dislocation—is a more safe compromise. Bullet wound of the knee-joint, is a case for amputation rather than excision; but a similar wound of the ankle-joint, is, more frequently, an appropriate condition for excision. Bullet wound of the shoulder or elbow-joints, are conditions in relation to which excision is, yet more frequently, a promising substitute for amputation. Thus, 13 out of 14 cases of excision of the shoulder were successful in the hands of M. Baudens. Of 12 cases of excision of the shoulder-joint, 2 were fatal; in 17 of the elbow-joint, 2 only were fatal; and in 5 partial excisions of this joint, all were successful. Such, according to Mr. Thornton, were the results in the British Army during the Crimean War. In the Russian Army, according to Messrs. Mouat and Wyatt's Report, of 20 elbow-joint excisions, 15 recovered.

In duly considering whether amputation should be primary, or *secondary*—to give the limb *its* chance; the large proportion of unfavourable or fatal results of secondary amputation, must ever be taken into account. During the siege of Sebastopol, there were 3000 amputations, among 80,000 wounded Russians. Of the primary amputations of the upper extremity, of the lower and middle third of the thigh, of the leg, and foot, about one-third recovered; but of all the secondary amputations, more than two-thirds died. These results are more than corroborated by those in previous wars. Thus, primary amputation was successful in three-fourths of the cases, under Larrey, during the Napoleonic Wars; whereas, of 300 secondary amputations, reported by Faure, after the battle of Fontenoy, 30 only were successful. In the Peninsular War, the loss after secondary amputations of the upper extremity, was, as compared with the primary, as 12 to 1; and of the lower extremity, the loss was three times as great.

The general treatment—hygienic and medicinal—in relation to gunshot wounds, is the same as, under similar circumstances, with regard to other contused or lacerated Wounds, Compound Fracture, and Dislocation. Hygienic measures are chiefly important, and they claim special attention in Military Camp Hospitals; where, owing to the contingencies of warfare, regimen, ventilation, and general cleanliness, are more than usually liable to be defective.

## CHAPTER XVII.

### MORBID CICATRICES.

MORBID CICATRICES are either failures of reparation in the healing of Wounds, or various conditions of its results—in the form of faulty cicatrices. They comprise:—(1) Deficient cicatrix; (2) Excessive cicatrix; (3) Painful cicatrix; (4) Ulceration, Growths, and Degenerations of Cicatrix.

(1) *Deficient cicatrix*.—A thin, flat, shining, reddish, easily wrinkled and cracked scar, remains, commonly, after the imperfect healing of a weak ulcer or scrofulous sore. Such a condition depends obviously on deficient reparative power of cicatrization.

*Treatment*.—Pencilling with nitrate of silver, sulphate of copper, or other stimulant application, and protection of the surface from any external occasion of inflammation or injury; constitute the most probably

successful topical treatment. Any causative constitutional condition may be less preventable or remediable.

(2) *Excessive, and exuberant or Cheloid cicatrix*.—An opposite condition to the preceding; this form of cicatrix is thick, more or less projecting, irregular, dense, and perhaps adherent. *Contraction* of such a cicatrix is not an uncommon character, and the force thus exerted may be so powerful and long continued, as to produce great displacement and deformity. This result usually follows cicatrization after a burn, particularly if it be deep and extensive. (See Figs. 47 and 48.)

*Cheloid* or exuberant cicatrix, is well defined, gradually rising, with a rounded border, and a smooth, level, or slightly convex, or sometimes centrally depressed surface. Its substance is always tough and firm, becoming more so as it grows older. At first, usually more vascular than even a recent healthy scar, and having a florid or purple tint; it gradually becomes paler as it becomes harder, and at length resembles healthy exuberant skin. In point of structure there is nothing peculiar; compact fibro-cellular tissue more or less completely developed or degenerate, and slightly vascular, is covered with a thin cuticle. The size of a cheloid growth is generally distinctive; rarely more than half an inch in thickness, or more than half an inch in any direction beyond the extent of scar in which it grows, the growth thus differs from a fibrous growth of skin which it nearly resembles. Exuberant cicatrix may arise from some local cause of irritation during cicatrization, or some more obscure cause of a constitutional character. The latter would appear to be the origin of cheloid cicatrix; considering its infrequency as compared with the frequency of wounds and scars, and that many such growths may appear in the same individual, and reappear in the scars of wounds made for their removal. Cheloid cicatrix may supervene on a completely formed healthy cicatrix, and even long after it has remained so; it grows slowly, and generally, after a long duration ceases to enlarge or diminishes, and it is liable to undergo degeneration and ulceration.

*Treatment*.—Strong stimulants, applied repeatedly, have some effect in dispersing an *excessive* cicatrix; apparently by inducing or favouring degeneration and disintegration of the already imperfectly developed fibro-cellular tissue, and thus facilitating its absorption. Further growth may at least be retarded or prevented in like manner. Iodine paint and mercurial ointments, will perhaps prove the most effectual of these applications. *Adhesion* of the cicatrix to subjacent textures and to bone, is best overcome by subcutaneous division, as was, I believe, originally recommended by Mr. Hancock. A cicatrix, hitherto intractable, will, when thus detached, contract, and not unfrequently close in rapidly. *Contraction* of the cicatrix—as after a burn—is more preventable than curable. Mechanical restraint by some form of contrivance adapted to the situation and extent of the ulcer, and applied as soon as the eschar is detached, will perhaps prevent the effects of contraction. Counter-extension, by similar means, in the direction of contraction, will less surely overcome its effects. But it may be necessary to continue such resistance for weeks or months; often taxing the ingenuity of the Surgeon, and trying both his perseverance and that of his patient. In accordance with pathology, the general principles to be observed are the following:—That scar-tissues seem rather to adapt themselves by changes of nutrition to the external forces brought to bear on them, than to be merely stretched by them; that, in however long a time, the natural course and tendency



of scars is to soften down to a greater resemblance to the natural parts in both structure and relations; and, that they are of low vital power, apt, therefore, to waste or ulcerate quickly under irritation, friction, or pressure, and are thus removable by absorption.

*Cheloid* cicatrix is removable only by excision, complete extirpation being necessary, and not even then a guarantee of non-recurrence; but a recurrent growth of this kind is not more intractable than the original one.

Plastic operations, planned according to the particular case, are available for the cure either of excessive or of *cheloid* cicatrix. The chief general rules for such operations may be thus stated:—That if the scar is to be removed, so as to bring healthy structures together for union in its place, no portion whatever of its substance should be left; that scar-tissues should not be used for the formation of flaps, or relied on for any speedy or sound union; that if the scar or part of it is to be included in any flap for sliding or transplanting, all the borders and surfaces of such flap intended for union should, if possible, be of healthy structure, and not themselves parts of the scar; and, that flaps should not be dependent on scar-tissues for their supplies of blood.

(3) *Painful cicatrix*.—Commonly arising from adhesion of the subjacent nerves to the skin or bone, and not attributable to bulbous enlargement of their cut extremities; the cicatrix of any wound may thus be painful, although most frequently that of a stump after amputation. Usually, the cicatrix-tissue is sound, but the nerves are subject to constant irritation or inflammation, varying with the mobility and movement of the part. *Neuralgic* pain, of an excruciating and paroxysmal character, is due rather to some constitutional cause affecting a cicatrix, still healthy in itself. This condition may supervene long after the cicatrix is completely formed, and has loosened from any subjacent adhesions in the natural course of healing.

*Treatment*.—Free subcutaneous section is almost sure to prove remedial, when the pain arises from *adhesion* of the cicatrix. It is readily accomplished by introducing a tenotomy knife from the centre of the cicatrix, which usually remains open as an intractable ulcer, and sweeping round the cicatrix, to beyond its circumference. In this way I lately succeeded in permanently curing a painful cicatrix over the projecting head of the astragalus, after Chopart's operation. I found it necessary, however, to remove a portion of the bone, in order to bring the margins of the ulcer together, and to divide the tendo-Achillis in order to prevent retraction of the stump and tilting forward of the astragalus as was the case before the operation. The result was, that the pain ceased and the ulcer healed over the stump, the tendon was permanently lengthened by gradual extension of the foot after operation, and the man walked well on the flat of the stump to the ground. This result was the more noteworthy and satisfactory, considering that, as a crucial experiment, I had previously divided the tendo-Achillis without any effect on the cicatrix. Neuralgic pain can only be cured, if at all, by constitutional treatment; chiefly by quinine, and careful regulation of the bowels. The topical application of aconitina will often temporarily allay this pain; a grain of the best preparation of the alkaloid to a drachm of lard, in the form of an ointment applied from time to time.

(4) *Ulceration*, and other morbid changes, *growths* and *degenerations*, affecting cicatrix-tissues, follow the same pathological laws as in other structures; and are amenable to the same *treatment*, accordingly.

## CHAPTER XVIII.

## BURNS AND SCALDS. LIGHTNING. FROST-BITE.

**BURNS and SCALDS.**—*Structural conditions, and Diagnostic characters.*—Formerly, burns were classified according to their different degrees of structural disorganization, as represented by, inflammation, suppuration, sloughing, and ulceration. Fabricius Hildanus, Boyer, and Dr. J. Thomson, observed only three degrees of disorganization; Heister and Callisen recognised a fourth; but Dupuytren\* was dissatisfied with this ground of classification, which regarded only the intensity of the burns, while the nature of the parts affected—the *textures* injured or destroyed—were altogether disregarded. He therefore superadded this kind of classification, by distinguishing burns according to their various degrees of *depth*, from the surface inwards to deeper parts.

Firstly.—Erythema, or simple reddening of the skin. Secondly.—Vesication, the cuticle being raised in blebs, filled with serum. Thirdly.—Incomplete destruction of the skin. Fourthly.—Complete destruction of the skin, extending down to and involving the subcutaneous cellular texture. Fifthly.—Conversion into eschars of muscles, nerves, vessels, and other soft-tissues to within a variable distance from the bone. Sixthly.—Charring and complete disorganization of the whole substance of the burnt part. Obviously, this classification recognises not only the various degrees of disorganization, beginning with erythema and ending with charring; but the various kinds of tissue—*i.e.*, *anatomical* differences—are also recognised as grounds of distinction. Thus may be enumerated, burns of the skin, and those involving the cellular texture, the muscles, nerves, vessels, and so forth.

The distinctions laid down by Dupuytren are, however, practically useless. *Deep* burns, to the fourth, fifth, and sixth degrees, extending successively through tissues having very different anatomical characters, are not attended with correspondingly different degrees of shock, they undergo the same process of reparation by sloughing and suppurative granulation, and with equal probability of recovery. It should also be observed that, as the textures successively destroyed by deep burns serve very different functions in the animal economy, the relative importance of such burns is not proportionate to the *physiological* character and importance of the parts destroyed. Nor again, is the Surgeon concerned with the *pathologico-anatomical* differences of burns. He estimates not the effects of heat on the body by observing the different degrees of disorganization produced in the various textures—that this eschar is yellow and hard, and that is black and brittle—as the geologist or mineralogist would examine specimens of igneous rocks. The insignificance of pathologico-anatomical differences—no less than those derived from anatomy and physiology—will become more clear, and the basis of the most exact and early diagnostic distinctions of burns be supplied, by observing, clinically, the functional disturbances pertaining to them, or their

\* *Leçons Orales de Clin.-Chir.*, 1832, tom. i. p. 423.

*pathology.* These lesions, indeed, afford an almost exceptional instance of the superior importance of this ground of diagnosis, as compared with that of clinical pathological anatomy—by virtue of physical and structural characters. [P. ch. ii.]

*Superficial* burns are most important, and in proportion to the *extent* of surface affected, but not necessarily destroyed structurally. The more superficial the burn, the more the skin alone is affected, if only extensively; the more urgent will be the constitutional disturbance, and the more dangerous is the burn. A negro employed at the Bains Vigier, in Paris, wishing on one occasion to warm his limbs, which were benumbed with cold during a rigorous winter, immersed himself in a bath heated to a high temperature. In a short time he experienced a general feeling of uneasiness with acute pain in the skin. He was immediately withdrawn and carried to the Hôtel Dieu, where he expired in thirty-six hours! It is reasonable to suppose in this case, that although the water was heated to a high temperature, yet it was not at the boiling point, and that it acted only as a general rubefacient, without raising or destroying the cuticle; and yet here was a burn of only the first degree, but very extensive, and therefore accompanied with a shock to the nervous system, so sudden and overwhelming as soon to have proved fatal.

*Deep* burns, when not superficially extensive, are of comparatively subordinate importance; their significance having reference generally to the remote consequences of such burns, namely, exhaustion by sloughing and suppurative discharge.

*Causes, and their effects locally and constitutionally.*—Heat applied to the body is necessarily the cause in all cases; but it may have been either by fire, as by the clothes catching fire, the explosion of gunpowder or other explosive compound; or by means of a hot or scalding fluid, as boiling water or molten lead. The lesions produced in the former way are commonly designated *burns*; in the latter way *scalds*. This distinction is of practical consequence; burns not unfrequently resulting from the more prolonged application of heat, are deeper lesions, but perhaps of less superficial extent; scalds resulting from the more momentary application of heat, are more superficial, but generally they affect a larger extent of surface. Any adhesive fluid, as boiling oil, is a more persistent cause, and boiling perhaps at a higher temperature than water, it affects the tissues to a greater depth, as well as superficially. Some such fluids, clinging to the surface, run over a yet greater extent. Thus, then, scalds may be even more severe than burns; both by the *duration* of the cause, and the extent of lesion, superficially and in depth.

Explosive compounds are destructive, not only as causing burns of considerable extent, but also by the mechanical violence of their explosion, producing wounds which might be called *burnt* wounds, contused or lacerated. Grains of gunpowder, grit, mud, or other material, may, moreover, be introduced as foreign bodies into such wounds. Wounds of this kind were well marked in the persons of the unfortunate victims of the "Clerkenwell Explosion," admitted under my care into the Royal Free Hospital. In all cases, the wounds were not only contused or lacerated, and ingrained with dirt, as if portions of flesh had been gouged out by extremely forcible splashes of mud; but the surface of these wounds and surrounding integument, were apparently burnt, and contused by the concussive atmospheric force of the explosion. All the wounds sloughed for some time, with a yellow, and freely suppurating



surface; healing very slowly by granulation. The cicatrix subsequently contracted, and assumed a seamed, puckered appearance, notably in the wounds of the neck; just like the cicatrix presented by the healing of a burn.

Burns and scalds immediately induce pain and shock, both of which are more or less severe according to the superficial extent of lesion. The symptoms of shock, affecting the nervous system and circulation, are the same as those arising from any other injury. But it is accompanied with congestion of internal organs; the brain, lungs, and mucous membrane of the gastro-intestinal canal. The duration of collapse is variable, averaging about 48 hours—two days.

*Course and Terminations.*—(1) *Shock*, or *Congestion*, proves fatal in many cases within the first two days; and indeed of all the fatal cases of burn, a great majority die in this period. Mr. Erichsen collected 50 fatal cases, and Mr. T. Holmes 75 such cases, of burn; the former, with a view of determining the organs most frequently affected in each degree and period; the latter, with the special view of determining the mode and cause of death. 35 out of the whole 125 cases, died on the first or second day; but as the great majority of those who are thus burnt to death are not examined, the proportion is much greater than this. Thus, of 119 other cases brought to St. George's Hospital, 79 died in this period. In 16—Erichsen's proportion—of the 35 cases, the brain and its membranes were found congested, with more or less serous effusion into the ventricles or arachnoid, in 15 cases. The brain in the other case was not examined. In the remaining 19 cases, the brain was examined only in a few, but in 1 only was it healthy in respect of structure and vascularity. The thoracic viscera were congested in 8 of the 16 cases, and in 6 of the 19 cases; the congestion having passed into demonstrable inflammation in 1 of the former, and in 3 of the latter; thus making thoracic congestion in one-half the cases examined. The abdominal organs were somewhat less frequently congested; in 12 of the 16 cases, in 3 only of the 19. The mucous membrane of the pharynx and larynx, is extremely liable to be congested, apparently owing to the inhalation of flame or heated air during the accident; of the 19 cases collected by Mr. Holmes, which died in the first two days, some appearance of this kind was found in 13. The congestion in the pharynx very generally ceases abruptly at the commencement of the œsophagus; in some rare cases passing down into the stomach.

(2) *Reaction and Inflammation* constitute the next, or second period; extending from the end of the second day to the end of the second week. During this period, 25 out of the 50 cases died; and 29 out of the 75 cases; or 54 out of 125. The brain, lungs, and intestines, are the viscera principally affected; laryngeal cases usually die earlier. In the 25 cases, the brain was affected in 14; 11 being simple congestion, and 3 serous effusion. Of the 29 cases, the brain was not examined in the great majority; but in 3 it was congested, with effusion into the ventricles or arachnoid; but there was no evidence of true inflammation in any case. The lungs are more frequently affected. In the 25 cases, these organs were congested in 10 cases, and inflamed in 5. Of the 29 cases, inflammation of the lungs or pleura had occurred in 7 (in one of which, however, it probably existed before the accident), and congestion was noted in 5 others. The abdominal viscera—liver, spleen or kidneys—are perhaps never affected as a consequence of burns, except by pyæmia. But, the

mucous membrane of the gastro-intestinal canal, is usually inflamed, and probably ulcerated; with, in some cases, evidence of peritonitis. Inflammation followed by ulceration of the duodenum, is a notable occurrence, in the second period of burn, to which Mr. Curling first drew attention. In the 25 cases, ulceration of this portion of intestine was found in 6; in the 29 cases, in 4 of them; making a total of 12 such cases out of 54. In 3 more of the latter series, enlarged glands were found, in 1 of which cases, the glands of the whole intestinal tract were enlarged.

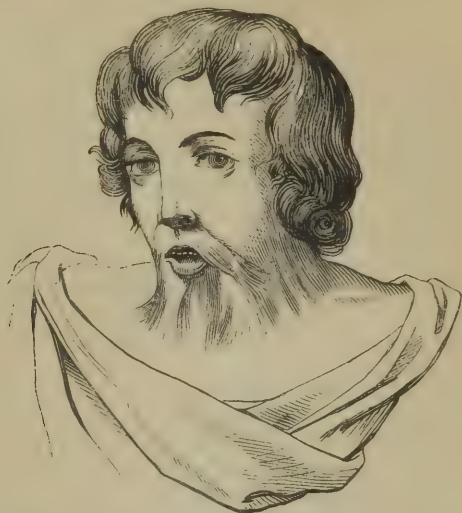
The *duodenal ulcer* is sharp-edged, and tolerably circular, as if a portion of the mucous membrane had been cut out; it is perfectly indolent, and usually situated just below the pylorus. Often there are two or three close together. Generally, the burn is on some part of the chest or abdomen. The earliest known period of duodenal ulceration is the fourth day; on the fifth day, it was noticed in 2 cases, and in 1 on the sixth. It usually occurs about the tenth day. This ulceration is unaccompanied by general inflammatory symptoms, or by any special symptoms. Persistent vomiting and bloody diarrhœa are the most reliable. Perforation of the bowel may ensue, and death take place suddenly from hæmorrhage, or from acute peritonitis. In one case, however, after death from other causes, at the end of eight weeks, a recent cicatrix was found in the duodenum.

(3) *Suppuration and Exhaustion, or Inflammation*, still prevailing, represent the third period; extending from the end of the second week to the termination of the case. The proportion of deaths at this period, was 9 in the 50 cases—less than  $\frac{1}{3}$ , and 27 in the 75 cases—more than  $\frac{1}{3}$ . Brain-lesions are accidental, being limited to infantile convulsions and pyæmia. The lungs or pleuræ are far more frequently congested or inflamed, and this condition is the cause of death. Thus, in 6 out of 9 cases examined in Mr. Erichsen's table—lesions of the lungs and pleuræ were noted. In 4 of these, the appearances were distinctly inflammatory; in the other two there was congestion with effusion into the pleuræ. Out of 27 of Mr. Holmes' fatal cases—during this period—the lungs were affected in 10, in 8 of which inflammation was the principal cause of death. Here, generally, the burn is situated on the chest. The symptoms—physical examination being precluded—are sufficiently marked; pain and oppression of breathing, hacking cough, and bloody expectoration. The gastro-intestinal mucous membrane is less frequently congested or inflamed; but ulceration of the duodenum is still not uncommon. Out of the 27 fatal cases referred to, in 6, open ulcers were found in the duodenum; in 1, a similar ulcer had undergone cicatrization, and in 1, the whole mucous membrane of the small intestines was inflamed but not ulcerated. In the other 9 cases referred to, no ulceration of the intestines was discovered. In 1 case only of Mr. Holmes' series, the jejunum and ileum were ulcerated, the duodenum being intact.

*Reparation.*—Burns and scalds undergo the same process of reparation, as similar lesions otherwise caused. But some features in their career are peculiar. Erythema, produced by a burn or scald, tends to subside, like any other simple cutaneous inflammation; resolution taking place with desquamation of the cuticle. Vesication also is resolved and terminates in like manner. Deeper burns involving, successively, the skin, subcellular tissue, and other adjacent textures; are followed by sloughing with the formation of eschars, abundant suppuration, and then the healing process of granulation and cicatrization. But the granula-

tions are exuberant, and the *cicatrix contractile*. At first thin, of a purplish colour, and shining, stretched, appearance; it immediately begins to contract, and contraction continuing for some months, with great and increasing force, the cicatrix gradually assumes a seamed and puckered

FIG. 47.



appearance; drawing together the surrounding parts, and ultimately producing strange deformity. Thus, remarkable distortions of the face and neck (Fig. 47), or of the joints are produced (Fig. 48).

FIG. 48.



*Tetanus*, *pyæmia*, *erysipelas*, and other affections may be omitted in estimating the causes of death as from burn; they being, rather, accidental concomitants.

The *period of death*, varies. The most fatal period is, perhaps, the



first week after the accident. Erichsen found that in 50 fatal cases, 33 terminated before the eighth day; 27 of these dying before the fourth day. Of the remaining 17 cases; 8 died in the second week, 2 in the third, 2 in the fourth, 4 in the fifth, and 1 in the sixth week.

*Prognosis.*—The chief considerations which determine the prognosis of burns and scalds, are—the more or less superficial character of the lesion and its extent, its situation, duration of the cause, and the age of the patient. The first two of these indications were sufficiently noticed in connexion with diagnosis; a *superficial* but *extensive* burn is far more unfavourable than a deeper and limited one. Hence many scalds are more fatal than burns. These indications, however, have reference to death principally by shock or congestion, in the first period, after burn; or by reaction and inflammation, in the second period. The *depth* of a burn—as compared with a scald—is significant with reference to suppuration and exhaustion, terminating fatally, in the third period. Deep burns are also unpropitious with regard to the part affected; distortion and loss of function supervening.

The *situation* of a burn, more especially indicates the probability of visceral congestion. Thus, burns on the chest or abdomen, are especially dangerous in relation to congestion of the lungs, or gastro-intestinal mucous membrane, respectively. Burns of the scalp are not so ominous of cerebral congestion; but they are specially unfavourable as regards the liability to erysipelas. The *duration* of the burning cause is, perhaps, favourable, as to the less liability of internal congestion or inflammation ensuing, but unfavourable so far as it implies a considerable depth of burn and consequent exhaustive discharge. *Age* has scarcely any relation specially to the prognosis of burns. Children are peculiarly liable to the danger of (secondary) visceral affections, cerebral, thoracic, and abdominal; and more easily succumb to their influence than adults. Extreme age is, of course, always comparatively unable to resist the shock, and consequences of injury.

*Treatment.*—(1) *Shock* and the tendency to *Congestion*, require immediate attention. Wine, brandy, ammonia, are the stimulants commonly administered to induce reaction. Warm tea may be sufficient, if the patient be young and the burn slight. Laudanum, in favour with some Surgeons, is, I think, undesirable, as being conducive to congestion. (2.) *Reaction*, occasionally excessive, must be moderated by any gentle depletory measures, otherwise than by loss of blood. Mild purgatives and the withdrawal of stimulants for a time, will generally reduce any undue reaction, as measured by the pulse and heat of the skin. It should ever be remembered that any temporary tendency to *inflammatory* symptoms, readily subsides into a congestive tendency, affecting the internal organs. (3.) *Suppuration* and *exhaustion*, are specially inevitable in the course of deeper burns; although some exhaustion supervenes in all burns. The strength of the circulation should therefore be retained for this period; and maintained when it arrives. Stimulants are again required, with tonics, and the generous diet suitable in cases of profuse and prolonged suppurative discharge arising from any cause.

*Local treatment.*—The primary indication is, protection of the surface from exposure to the action of the air. Increased and persistent pain and shock will thus be prevented. Various topical applications are used protectively, and sometimes indiscriminately.

The degree or depth of burn, will, I think, best determine the choice.

*Erythema*, or vesication, cannot require any application more than simply protective. "Carron-oil," consisting of equal parts of linseed oil and lime water, answers admirably. Lint, dipped in this thick, yellow, pul-taceous fluid, forms a covering, at once exclusive of atmospheric influence and emollient. Deeper burns, destroying the cuticle, skin, and so forth, thus presenting an exuding surface, are perhaps more advantageously covered with some absorbent material. Flour, dredged over the surface soon forms an encrusting artificial skin. This need not be removed until loosened by increasing discharge and separation of the eschar. The removal of this crust by the Surgeon would be attended with great pain, and damage to the surface about to heal, and would aggravate the constitutional disturbance. But, the possibly irritating character of this kind of dressing, and the impossibility of removing it, without these evil consequences, are serious objections to any such application. Cotton-wadding wrapped around the part forms a good protective covering, and aids in restoring the temperature of the part, a consideration of importance in proportion to the extent of surface involved; but this application alone is objectionable for the same reasons as the flour-dressing. Carron-oil dressing, enclosed it may be with cotton-wool, is, generally, the most eligible application.

The ulcer formed by the detachment of the eschar, must be treated agreeably to the general directions already given with regard to Ulcers. Water-dressing, or a weak solution of nitrate of silver, will then be appropriate, according to the state of the granulations. Pencilling the marginal granulations with nitrate of silver or sulphate of copper, may be necessary, to repress their exuberant growth, and favour cicatrization. No dressing in the whole course of treatment, should be reapplied unnecessarily; its removal being attended with great pain, and much increasing the constitutional disturbance. One of my earliest recollections as a student, was that of witnessing the shrieking of a patient during the dressing of a large burn over the thorax and abdomen, the muscles quivering and bleating by exposure to the air.

*Contraction of the Cicatrix* is the grand difficulty to be prevented or overcome. In anticipation of this event, Dupuytren recommended attention to position and the application of counteracting mechanical contrivances, as soon as the eschar had become detached and during cicatrization. But any such adjustment of splints and bandages or other apparatus, will generally prove effectual only for a time; the cicatrix contracting when left free, and at length presenting its usual appearance and the accompanying deformities.

*Operations*, therefore, are practised with the view of overcoming contraction. *Division* of the cicatrix has often been tried, but with little permanent success. Complete division is necessary, both as regards the extent and depth of the cicatrix, any subjacent bristles must also be freely divided. All contraction having been thus overcome, extension should be maintained mechanically during granulation and cicatrization in the lines of incision. With every precaution, however, the new intervening cicatrix-tissue is apt to acquire the same evil disposition. I have had recourse to this operation in many cases, and repeatedly in the same case; but with no more successful results than in the hands of other surgeons. *Transplantation* of a flap of healthy skin into the gap made by division and extension of the cicatrix. This proceeding is far more generally successful, permanently. Very happy results have been attained by Teale, Mütter, and James in thus overcoming the deformity occasioned

by burns of the face and neck. Eversion of the lower lip into the chin, a disfigurement attended with slobbering peculiarly revolting, may be remedied by Teale's operation. The everted lip is divided into three equal parts, by two vertical incisions, each three-quarters of an inch in length, and carried down to the bone. These incisions are so placed that the middle or intervening portion occupies one-half of the lip. From the lower end of either incision, another is carried upwards to a point one inch above the angle of the mouth. The two flaps, thus indicated, are freely and deeply dissected up. The alveolar margin of the median portion is then pared. The lateral flaps are raised, united by twisted sutures in the middle line, and supported as on a base by the median flap, to which they are also attached by a few points of suture, leaving a triangular even surface to granulate. Gradual extension of the cicatrix from the sternum, and elevation of the chin can be accomplished by means of a screw collar devised by Mr. James.

*Diseased conditions of the cicatrix* have received sufficient attention in this work among Morbid Cicatrices, in general. Erichsen notices particularly a projecting red and glazed cicatrix, looking as if composed of a mass of fungating granulations smoothed down and lightly skinned over. This warty cicatrix—observable after burns about the neck and chest, more especially—resembles cheloid growth, but is remarkable as being the seat of intolerable itching, not relieved by any external application. Large doses of liquor potassæ mitigate this distressing symptom. But, if small and narrow, the cicatrix may be dissected out; if large, it does not admit of removal without risk of considerable hæmorrhage, as the structure, though fibroid, is very vascular.

*Amputation* is an operative resource unavoidable in certain external cases. Complete destruction, by charring, of the whole substance of a limb, leaves no alternative; or, as a secondary operation, it may become advisable under circumstances, locally and constitutionally, analogous to those resulting from other forms of injury.

LIGHTNING produces effects, locally, in the direction of its course through the parts, resembling the appearances of an ordinary burn; but the shock may suspend the functions of the nervous system, partially or generally, without any marked appearances of burn, and may thus also kill instantaneously.

A *stroke* of lightning affecting the brain, knocks down the individual with loss of consciousness; lasting from a few minutes to a longer period, in one case an hour and a quarter. Recovery shows that paralysis was suddenly produced, partially or completely; and this state may continue for an indefinite period. The special senses are variously affected; loss of sight, smell, hearing, and taste; or more rarely, exaltation or perversion of these functions may have occurred. Hæmorrhage from the mouth, nose, or ears, sometimes happens; and abortion in some cases. A remarkable effect is said to be produced occasionally; the formation of an image, as if photographic, of neighbouring objects on the body, even on parts covered with clothes.

Every degree of *burn* may be produced, and perhaps in the same person, from the slightest singeing of the hair, reddening or blistering of the skin, to the deepest charring. Other incidental injuries may occur, but rarely, such as wound, or fracture, particularly of the skull. The tongue was mutilated in four out of six cases of injury recorded by M. Bondin.



The *prognosis*, partly guided by the same considerations as with regard to Burns, is generally more favourable respecting the local lesion, which may be comparatively trivial, and also in respect to shock. But the subsequent paralysis or other functional disturbance may be a specially unfavourable condition, as consequent on a stroke of lightning not immediately fatal. Some persons seem to have *premonitory* symptoms of the approach of a thunderstorm. One such individual, within my own knowledge—a remarkably robust young man—is invariably troubled with extreme nervousness, headache, and an indescribable dread, compelling him to go to bed some hours before any apparent approach of a storm. How far this might be an unfavourable state of the nervous system is unknown.

*After death* by lightning, certain appearances are remarkable if not characteristic. The attitude of the body may be that in which it was when struck, or the body may be thrown to some distance from the spot. Rigor mortis, occasionally absent, is commonly present, and well marked, or even to an intense degree of rigidity, resembling the condition of a person frozen to death. The blood, sometimes coagulated, is usually singularly fluid, and continues in this state. Decomposition is sometimes speedy, but often delayed. The clothes are generally burnt or rent, even when the body is intact.

The *Treatment* of suspended animation from a stroke of lightning consists in artificial respiration, with warmth and stimulants to restore the circulation.

**FROST-BITE.**—Cold, intense or long continued, produces effects analogous to those of heat. It may kill the part directly, a local destruction analogous to charring, and accompanied with depression of the nervous and vascular systems, analogous to shock; or the part dies by the speedy supervention of gangrenous inflammation, a process of destruction accompanied with inflammatory reaction as the constitutional disturbance. Unlike heat, cold more frequently kills by its direct operation; presenting the condition known as frost-bite. This local effect, moreover, frequently exceeds in importance the concomitant general depression of the system.

The *local* condition may therefore be taken first in order. The symptoms are—loss of sensation and power of motion in a muscular part; and, the circulation becoming arrested, a remarkable pallor overspreads the surface, deadening into a stone colour, with stiffness increasing to hardness, and even brittleness of the part, when quite dead.

The *constitutional* disturbance arises principally from general exposure of the body to cold, under the circumstances of frost-bite. Languor, and an overpowering sleepiness, ending in stupor or coma, invariably supervene during prolonged exposure to severe cold, and may thus cause death, the part itself dying with the general failure of life. The whole body becomes frozen by more continued exposure, and thence the condition known as “frozen to death.”

A part frozen or frost-bitten is not irrecoverably *dead*. A whole limb may have become perfectly insensible and cold as ice, white and transparent like marble, incapable of being bent without breaking; and yet not absolutely dead. The combs of cocks and the ears of rabbits were frozen by Hunter, but these parts afterwards recovered. Leeches and frogs have been placed in the same state and then restored to life. Cold-blooded animals, and parts of warm-blooded animals, when frozen, are,

therefore, not dead, but asleep as it were, and can be aroused ; even as a seed is ready to sprout, awaiting circumstances favourable to life. How long a frozen part or animal may retain its susceptibility of life is uncertain ; but this is certain, that unless reaction be gradual, the returning flow of blood is apt to become excessive—to pass into inflammation, speedily ending in gangrene. While, therefore, gradual and moderate elevation of temperature induces salutary reaction and restoration, sudden or immoderate accession of warmth will inevitably excite gangrenous inflammation.

*Treatment.*—In the dormant state of any part of the body from frost-bite, when although apparently dead the part is recoverable, pathology suggests the solicitation of reaction short of inflammation ; and thence the prevention of gangrene with loss of the part.

Restorative reaction can only be accomplished by the moderate and gradual application of warmth. Friction with something of nearly the same temperature as the frozen part, fulfils this two-fold indication ; and thus, rubbing the part with snow is a practice both surgical as well as popular. A tingling or burning pain, and purplish redness, announce the returning circulation and tendency to inflammation.

Gangrene having supervened, the separation of the slough should be left to Nature ; any unnecessary interference would give a fresh start to the process of destruction, in textures reduced to a low state of vitality.

Amputation may become necessary, as after a burn ; the operation being performed also in point of time and situation, after the formation of the line of demarcation and above it.

## CHAPTER XIX.

### CELLULITIS. CARBUNCLE, AND BOIL.

CERTAIN Blood diseases are declared by local inflammations of the subcutaneous cellular texture.

*CELLULITIS.—Structural Condition.*—The textural changes wrought by this inflammation are these :—Speedily an effusion of serum engorges the subcutaneous tissue ; this being soon exchanged for a purulent, bloody, sanious fluid. The cellular membrane dies rapidly, appearing in the form of shreds and skeins, and as mats of wet tow, or like large wads of wet shammy-leather ; extending over a whole arm, a whole side, or over both, successively. An immense extent, therefore, of cellular texture is sacrificed, and this wide-spread subcutaneous slough passes in between the neighbouring muscles ; but the fasciæ are singularly spared ; thus the tendinous septæ between the ribs are seen bared in places where the muscular substance itself and all other textures have disappeared. This process of destruction probably involves the skin, and to a corresponding extent. Yet vesicles or bullæ seldom appear until the subcutaneous inflammation is very far advanced. These vesicles are in general solitary, sometimes remote from the cellular disease, of considerable size, and occasionally filled with bloody serum

*Symptoms, and Diagnosis.*—Cellulitis might be mistaken for erysipelas. The swelling is not unlike,—in both diffuse and œdematous. But the pain is at once the earliest and most distinctive symptom ; it is excru-

ciating. This, without perhaps any, even the slightest blush of redness, is characteristic of cellulitis. And should the skin become involved, the cutaneous inflammation is always *secondary*, in all cases of true cellulitis; by advance from below upwards, from the cellular texture to the skin. This latter texture remains uninfamed, or is not primarily and essentially affected.

*Fever.*—The fever which precedes and accompanies cellulitis, aids but little to establish an early and exact diagnosis. In those cases which Duncan observed, this fever had so much of the typhoid type, that it was scarcely possible to foresee which disease would be eventually declared. Nevertheless, the fever presented considerable varieties in respect of its symptoms and progress. It sometimes commenced insidiously, sometimes turbulently, but in most of the severe cases soon reached its height. Its chief peculiarities were; the supine position with depressed shoulders, in which attitude the patient almost always lay, without turning to either side, the absence of coma, and the rare occurrence of delirium. The respiration was often remarkably embarrassed, owing to the inspiratory muscles,—pectorals, intercostals, &c., being the seat of cellulitis. In some cases, dyspnoea was rendered more urgent by pleurisy. In others, the respiration was itself much affected, especially when the disease began in the arm. Certain facts of apparently minor significance, because only occasional, are; a peculiar cadaverous smell emitted from the patient's body during life; in one case, a fœtid and coloured sweat proved critical.

*Blood origin.*—Two facts at least point to the inference that cellulitis is the local manifestation of a blood-poison.

The fever being *typhoid*, resembles the working of some blood-poison analogous to that which is undoubtedly in operation when typhoid fever is engendered by "infection;" and the local manifestation itself—cellulitis being a "serpiginous" inflammation—extending continuously, and not confined to one spot, shows that some morbid condition of the blood disturbs the course of textural assimilation.

*Blood-pathology.*—The nature of the blood-poison is wholly unknown. The best account of this disease is given by Dr. Duncan.\*

*Treatment.*—*Preventive* measures are unknown, nor can they be discovered until the etiology of this disease is better understood. The *remedial* treatment, so far as art has any controlling influence, is substantially the same, both constitutionally and locally, as for phlegmonous erysipelas.

CARBUNCLE and BOIL are alike, essentially, inflammations of the subcutaneous cellular texture, which may occur in various parts of the body; but the effusion is *circumscribed* and brawny, so that the imprisoned cellular tissue invariably sloughs. Certain differences are worthy of notice.

CARBUNCLE or ANTHRAX is a flat, oval or circular, somewhat spongy swelling, having a brawny circumscribed border; the whole swelling being of a dusky, reddish-brown colour, and very painful,—burning, contracting or throbbing. The size of this swelling varies from half-a-crown to that of a dinner-plate, and it varies also with the progress of the inflammation. Increasing slowly, at length the skin over the flat surface, sloughs at numerous points, forming as many small apertures, through which a greyish sloughy and purulent, fœtid discharge oozes, or starts

\* Trans. Med.-Chir. Soc. Edin., 1824, vol. i.



up on the slightest circumferential pressure; presenting a cribriform appearance never to be forgotten when once seen, peculiar to carbuncle. As sloughing of the skin advances, the apertures run together and coalesce, the cribriform surface disappears, and discloses the subjacent cellular texture, a quagmire of slough. Carbuncle is commonly situated about the shoulders or on the nape of the neck, where if large it gives a remarkable breadth to that part. Occasionally occurring on the lower part of the back or sacrum, it may form on the front of the chest or abdomen, sometimes on either extremity, and very rarely on the forehead or face. One on the nose, seen by Sir B. Brodie, gave the most singularly hideous appearance, completely disguising any lineaments of the human face. Fortunately, carbuncle is usually solitary.

*Fever* of the typhoid character precedes and accompanies the swelling, and it becomes more marked as sloughing ensues. But there is also a notable derangement of the liver and other digestive organs, indicated by a yellowish complexion and brown furred tongue.

The *causes* of carbuncle are, as to their essential or pathological nature, obscure. It is a disease of advanced years, or it occurs in those whose constitution has broken down prematurely. It is also induced by habitual free living, without exercise. It is associated, not unfrequently with diabetes mellitus or albuminuria; and swellings of a carbuncular character are not uncommon in some infectious diseases, as typhus and typhoid fevers, and plague.

*Course and Terminations.*—Generally, the slough of cellular texture having been thrown off or removed, the cavity, often of considerable size, slowly heals by suppurative granulation; and the patient's health is ultimately regained, a marked improvement having taken place when the slough was detached. But the brawny induration remains for some time, and a puckered cicatrix permanently. Sometimes, however, the sloughing deepens as well as extending superficially; and involving important subjacent parts, or overwhelming with prostration, thus proves fatal. A large carbuncle situated on the nape of the neck is especially perilous. Rarely, a carbuncle subsides suddenly, and the person rapidly sinks. A remarkable instance of this mode of fatal issue, is related by Sir B. Brodie.\*

The *prognosis*, in different cases, will be guided by the foregoing considerations.

*Treatment.*—*Preventive* measures are said to be occasionally successful. In the earliest stage of the disease locally, while yet only "a small pointed vesicle on a hard, brawny base," observes Mr. Erichsen, its further progress may often be completely arrested by opening the vesicle and rubbing its interior with a pointed stick of potassa cum calce or nitrate of silver. Later still, he has often seen the extension of a carbuncle prevented and a cure effected, by covering it with a square of soap-plaster spread on thick leather, with a hole in the centre for the exit of discharge. I have had no experience of a carbuncle in this stage, nor of the preventive treatment accordingly. *Curative* Treatment consists chiefly in a certain operative proceeding. The preservation of as much integument as possible, by the limitation of sloughing, with the relief of pain and constitutional disturbance, are primarily important; and the discharge of slough subsequently is equally so. Early relief of tension fulfils the

\* Pathology and Surgery, 1846, p. 393.

former indications, an outlet fulfils the latter. Timely, free incisions, fulfil both. A *crucial* incision, carried through the slough and the surrounding induration, answers admirably. The *period* for making this double incision, must be determined by due observance of both the purposes in view; always inclining to the consideration of relieving tension. A free application of potassa fusa, after the bistoury, was recommended by the late Professor Miller, in order to at once form an eschar and thus limit sloughing. Poulticing until the slough is discharged, and then dressing according to the state of the ulcer, are the only applications ordinarily required.

The constitutional treatment, medicinal and dietetic, much resembles that of phlegmonous erysipelas. Early recourse to stimulants, tonics, and a generous diet; but with special attention to the state of the liver and digestive organs. Yet here we encounter the chief difficulties. Inappetency, nausea or actual sickness, and mal-assimilation, all conspire to defeat our alterative mercurials and effervescing salines, as well as our endeavours to coax the stomach with digestible and nourishing food. If any other disease, to wit, diabetes or albuminuria, be associated with carbuncle, such complication will further embarrass the treatment.

**BOIL or FURUNCULUS.**—In some of its external characters, Boil contrasts with Carbuncle. It is a *conical* swelling, softening as it matures, but set in a hard base; of a purplish red colour, and exquisitely painful and sensitive. Its *size* is much more moderate than carbuncle, never perhaps exceeding the smallest swelling of that kind, about half-a-crown. Its smaller size and conical shape are diagnostic, even in an early stage. Enlarging slowly, matter forms at the apex of the cone, tipping it with a yellow colour; this point bursting, at length discloses a subjacent slough or core of cellular texture. But, the cribriform, flat, surface of carbuncle is never seen,—another diagnostic difference. Like carbuncle, a boil is commonly situated where the skin is thickest; on the back of the neck, shoulders, or the buttock, a favourite spot of election; occasionally in the arm-pit, or on the thigh. They always seem to choose the most troublesome situations. To increase the torment, they seldom come singly, but are gregarious or successive.

*Feverishness*, generally of a more sthenic character than with carbuncle, accompanies the formation of boils.

The *causes* also, so far as they are known, somewhat differ from those of carbuncle. Usually occurring in earlier life, boils are also connected with a plethoric state of the system; but they may denote an enfeebled condition, or they may appear in the sequel of febrile diseases. Their fitful character is often far less explicable. Active exercise by persons of sedentary habits, sea-bathing, the spring-time of the year, or some epidemic influence, will, perhaps, severally suffice to bring out a crop of boils.

The *treatment* is that of carbuncle on a small scale. A poultice or warm fomentation, to promote suppuration and detachment of the slough, should be followed, if the latter does not take place, by a sufficient incision for expulsion of the core without any thumbing or squeezing. With water-dressing, the little granulating wound will then look after itself.

Constitutional measures must have reference either to the plethoric or debilitated state of the system. Alterative mercurials and saline aperients, followed by liquor potassæ and other alkaline treatment; or quina, iron, and nitro-muriatic acid, the acid-tonic treatment.

**CHILBLAIN.**—This is a local inflammation of the skin, of an asthenic type; and subject, perhaps, to regular recurring attacks of congestion. It occurs in three degrees:—(1) Simple congestion, attended by great itching, alternating with periods of extreme tenderness to external pressure; (2) or, in the form of vesication; (3) death or sloughing of the affected portion of skin, and perhaps of the sub-cellular tissue, forming an ulcer of an indolent character.

The *Symptoms* of chilblain are obvious, in connexion with each of these forms of this affection. Congestive purplish-redness, with a tingling, itching, or burning heat or pain, which comes and goes, and some degree of swelling which has a shiny appearance. Recurrence of the symptoms seems to be determined by circumstances affecting the circulation, as exposure of the part to the warmth of a fire, or of a periodic character, as the stimulant effects of daily meals. The vesicated and ulcerated forms of chilblain present appearances which are sufficiently indicated by these terms. Certain parts of the body are most commonly affected; the feet, hands, or both; more rarely, the lobes of the ears, or even the end of the nose.

The *causes* of this affection may be said to be, sudden variations in the external temperature, and in connexion with the predisposing condition of a weak circulation. Hence, chilblain is liable to occur in persons of the leucophlegmatic temperament, or of a scrofulous constitution. Age has decidedly some influence; it happens most frequently in young persons or children, and of both sexes; and in adult females more often than in men. This liability generally passes off towards manhood; and chilblains are rarely met with in men over forty years of age, though in weakly women they may recur throughout life. Local causes affecting the free circulation in the part, should not be overlooked; such as tight gloves, elastic bracelets and garters, tight shoes, the sitting posture, long continued, in cold rooms, with the legs pendant.

*Treatment.*—*Preventive* measures will consist in promoting the general circulation; by an even temperature, particularly as regards sleeping and sitting rooms in cold weather, warm under-clothing, socks and gloves, with regular exercise; and, the removal of any restraint to the circulation in exposed parts of the body. A generous diet, with small stimulant doses of opium and quinine, may likewise prove salutary. In the event of any chill, affecting particularly the feet and hands, the circulation should be restored very gradually, by frictions and warmth. *Curative* treatment consists, when chilblains are unbroken, in bringing the congestive inflammation to resolution, by daily frictions with stimulating embrocations, as of camphor or tincture of iodine, and soap liniment. The old-fashioned remedy, brandy and salt, should not be despised. Intolerable itching might, perhaps, be relieved by lead-lotion, or opiate ointments. Vesicated chilblains may be protected by a coating of collodion and castor-oil varnish. Ulcerated chilblain must be treated by poulticing rendered stimulating by admixture with spirits of wine, or turpentine, until any slough separates; and then the dressing may be resin-ointment, or other topical applications, as for any other weak or indolent ulcer.

**WHITLOW OR PARONYCHIA.**—An asthenic inflammation of the dense fibro-cellular tissue forming the pulp of the finger or thumb; this part becomes acutely painful, tense and hard, swollen so as to give a globular appearance to the end of the finger, and of a reddish colour (Fig. 49). The inflammation and swelling are always diffuse—unlike phlegmon; and



it tends also to suppuration and sloughing of the cellular texture,—thus also differing in its termination. Necrosis of the ungual phalanx is not an uncommon event, in prolonged cases. Whitlow occurs spontaneously in persons of a naturally weak or of a debilitated constitution, affecting both

FIG. 49.



young and old, and either sex. Occasionally, it appears to have an epidemic character, arising in many persons without any traumatic cause; and perhaps at certain seasons, as in the spring. But it arises frequently from some local irritation, as a puncture, scratch, or inoculation with some poisonous matter. Hence, it is more frequently met with in connexion with certain occupations, as in cooks, washerwomen, and grooms.

Whitlow, involving the *sheath of the tendons*, is a more severe form of this affection. It is attended with greater swelling of the whole finger, extending to the hand, which becomes much puffed and enlarged. Shooting pain up the arm, and more violent throbbing with suppuration, are experienced; but the redness is not proportionate, and the end of the finger, particularly if the cuticle be thick, and the palm of the hand hardened by work, may assume a dull-white appearance—soddened, perhaps, by poulticing. Some inflammation of the lymphatics, denoted

by red lines extending up the arm, not unfrequently accompanies this form of whitlow, and with much low feverishness or constitutional disturbance. Diffuse suppuration soon takes place in the sheath of the tendons, and may even spread up the fore-arm, under the annular ligament. The swelling has an elastic character, but distinct fluctuation is obscure. Sloughing ensues, not only of the cellular texture of the finger and hand, but also of the tendons and palmar fascia. Necrosis of the phalanges results; or a matted state of the part, with a rigid and contracted state of the finger and perhaps of the hand, rendering the part useless.

*Treatment* is primarily, the prompt employment of repressive measures; by leeching, poulticing, and an elevated position of the hand. In the *simple* form of whitlow, a crucial incision into the pointed swelling of the pulp of the finger, should be made at an early period; or even snipping the vesicated summit will give great relief. In the *tendinous* form of whitlow, early, and free, longitudinal incisions, along each side of the finger, must be had recourse to, for the relief of tension and swelling. The digital arteries should be avoided, and the sheaths of the tendons not opened,—to prevent sloughing, and rigidity of the finger ensuing. Then well soak the finger, and hand, in warm water, and envelope the whole with a poultice. The nail, which growing and elongating, may appear large, often loosens, and should then be removed by evulsion with a small pair of sequestrum-forceps. Otherwise, as a foreign body, it would be a source of continued irritation. Any adherent portion need not be removed, but the remainder of the nail may be pared and scraped. A new nail will form, if the matrix be healthy; probably taking a period of five or six months, before it is completely restored. In tendinous whitlow, when the inflammation has subsided, a pasteboard splint will be advisable, to prevent contraction.

*Necrosis* of the unguis phalanx will necessitate the extraction of this dead portion of bone; leaving the pulp end of the finger and nail, which eventually form a somewhat hooked extremity, tolerably sensitive and useful, and not so unsightly as a truncated end. Amputation will be unavoidable, in the event of more extensive destruction, involving the middle, or the first, phalanx. And it is better to operate rather, apparently, too high, than too low for the sake of preserving a useless remnant of a finger; any portion of the thumb, however, will be most useful. The general health must be renovated by tonics and diet.

ONYCHIA is a form of ulceration, which commences about the matrix of the finger-nails. It usually arises from a pinch or crush of the finger end, bruising the matrix or loosening the attachment of the nail. Shortly after this injury, the finger-end swells, and fluid is effused beneath the nail, which loses its natural colour, and becomes thin and flattened at the end, or more rarely curled up laterally. As the nail continues to grow, it turns upward and exposes beneath it, a very foul, fætid, and painful ulcer; while the finger-end becomes enlarged and bulbous, the integument hardened, shining, and of a livid red colour. This affection occurs mostly, according to Mr. Thomas Smith's observations, in children under ten years of age; but that it is by no means common. It is little prone to spontaneous recovery; proceeding, perhaps, to necrosis of the unguis phalanx. The disease is sometimes named *onychia maligna*, as a *specific* ulceration.

*Treatment* is firstly, evulsion of the nail; and this is accomplished either by tearing it off as a whole by seizing it with a narrow-bladed pair of sequestrum-forceps; or, by dividing the nail with a narrow-bladed pair of scissors, run up to the root of the nail, and then everting each half with the forceps. Both scissors and forceps must be applied with a firm hand. Local anæsthesia will suffice to completely deaden sensibility—the pain otherwise being excruciating. Pounded ice and salt mixed in a bladder is convenient for this purpose, or Dr. Richardson's ether spray is equally efficacious. Water-dressing or carbolic lotion may then be followed by arsenical solution—one or two drachms of the liquor potassæ arsenicalis, to an ounce of water. Chlorate of potash and tonics, especially bark, complete the treatment.

*Syphilitic* onychia, as a secondary affection, has already been noticed.

IN-GROWN TOE-NAIL.—This is a not uncommon condition, among especially the working-classes; it may occur on either side of the great-toe nail, but more frequently on the outer side. It is attended with considerable pain in walking, and gives rise to fungoid and sensitive granulations, overspreading and concealing the in-growth, accompanied with a thin, fætid discharge. This condition is caused apparently, either by overcrowding the toes in a narrow, hard boot, thereby thrusting the adjoining integuments over the side of the nail; or, by the toe-nail having been pared away too deeply at the side, thus allowing the integument to overlap; in either way the nail grows into and includes itself in the overhanging fold of integument. *Treatment* consists in removing any cause of pressure, as a tight, or hard-toed boot, and then endeavouring to correct a faulty growth of the nail. The pressure of the integument on the nail may also be relieved by neatly inserting shreds of oiled cotton-wool into the cleft by means of a probe on the back of a scalpel-blade. Then, when sufficiently separated in the course of some days, the margin of the nail may be gradually raised in like manner, until the natural state of the part is restored. Scraping the edge of the nail very thin may prove to be

sufficient relief; or, by notching the free edge down to the matrix, the strip of nail as it grows, may gradually overlap the body of the nail, and thus bring relief. Any obstinate or deep in-growth can only be cured by evulsion of the nail, as in the treatment of onychia. After any such mode of cure, the fungoid granulations will subside, or they may be repressed by pencilling with nitrate of silver or sulphate of copper. Zinc ointment may be applied during the healing.

**CORNS.**—Local hypertrophy of the cuticle forms the common corn; a flattened or conical swelling, hard or soft, often acutely painful—varying in this respect, according to pressure on the part, the state of the health, and even the weather. Such cuticular out-growths occur commonly on the feet, usually on the outer aspect of the end of the little toe; or between the toes, and then always as a soft corn, apparently from maceration of the cuticle by warmth and moisture. Occasionally, corns form on the hands, and more rarely over the prominences of the elbows or knees. They are produced by intermittent pressure or friction on some naturally prominent part, as on the little toe, by wearing a tight, hard boot. Eventually, beneath an old corn, a bursa is apt to form, which, becoming inflamed from time to time by pressure, greatly aggravates the pain and inconvenience in walking. Suppuration is liable to occur.

*Treatment.*—Relief is obtained by simply removing the cause of pressure. Wearing a loose shoe or slipper, or protecting the corn by means of a circular plaster of thick leather, having a hole in the centre over the corn. Thus, the common “corn-plasters” are used. Pencilling with nitrate of silver induces desquamation, and thus thins down the corn. Paring or scraping down the corn previously macerated in warm water, will also give relief, as occasion requires. Extraction of the centre or core of the corn, is the ordinary practice of chiropodists. But the full-grown corn is liable to return. Inflammation and suppuration must be treated on ordinary principles.

**Horns.**—Remarkable forms of out-growth, consisting of fibrous or fibro-cellular texture, are liable to occur on various parts of the body; springing from the various sebaceous cysts, unruptured, or ruptured spontaneously or by accident. Similar kinds of out-growth may arise from the matrix of one of the toe-nails, especially the great toe; extending from one to four inches in length, tapering at the point, and curved spirally like a ram’s horn. This is simply a vertical elevation of the epithelial layers forming the nail.

*Excision* completely from the base of the horn is the only cure.

**WARTS or VERRUCÆ** are collections of overgrown cutaneous papillæ, either completely ensheathed by an excessive production of scaly epithelium, or with the papillæ isolated, each having only its own natural cuticular sheath. They may occur in various parts of the body, a common situation being the hand and fingers. Warts may arise spontaneously, apparently, or be congenital, or perhaps hereditary; but usually they proceed from some source of local irritation—as dirt or discharge, or from the handling of animal matter, in cooking or dissection. They occur in girls who have the evil habit of masturbation, though the presence of warts on the hands should not alone beget an unworthy suspicion of such practice. Venereal warts, excrescences, or vegetations, well illustrate the origin of warty growths from irritative discharge. Such and similar warts are undoubtedly contagious. Common warts come and go, sometimes, in an unaccountable manner.



*Treatment.*—Escharotics may succeed in removing these often obstinate out-growths. The strong acetic acid, applied by means of a glass-brush, or rod, is the most efficacious. Excision with the knife or curved scissors, is the only other mode of cure.

**MORBID GROWTHS.**—Besides Warts and the other cutaneous out-growths already referred to, the skin may be the seat of tumours or morbid growths—*e.g.*, painful subcutaneous tubercle, nævus, epithelial cancer. (See Ch. II.)

**ULCERS.** (See Ch. IV.)

## MUSCLES AND TENDONS.

### CHAPTER XX.

#### SPRAIN.—RUPTURE.—TUMOURS.

**SPRAINS OR STRAINS.**—*Structural Condition, and Symptoms.*—Muscular and tendinous structures are liable to be suddenly stretched by violence, without any actual or perceptible rupture of fibre. This lesion commonly occurs to those muscles which are most apt to be brought into action by any sudden and violent exertion, as in running, leaping, dancing, or lifting a weight. Immediate pain and inability to use the part, followed by stiffness, are conclusive symptoms. Any degenerative change, or softening of the structure, will predispose to this kind of injury. It may be succeeded by atrophy and partial paralysis.

*Treatment.*—Rest is necessary for reparation, and this requisite is secured by the renewal of pain from any attempt to use the damaged muscle or tendon. Subsequently, friction and stimulant embrocations aid in overcoming the stiffness and removing any remaining thickening.

**RUPTURE OF MUSCLE AND TENDON.**—This lesion may be regarded as only a further degree of sprain, but it presents certain additional particulars of importance.

The part of the muscle or tendon ruptured is in the muscular substance, the junction of the muscle and tendon, the tendon, or the junction of the tendon and bone. In twenty-one cases Sédillot found the rupture had occurred at the junction of the muscle and tendon in thirteen, but through the muscle in eight only. Occasionally, the sheath of the muscle or tendon is ruptured; a protrusion taking place through the aperture. This more frequently occurs to the long head of the biceps muscle, or the extensor tendons of the fingers. The muscles most liable to sprain are also subject to rupture, by sudden and violent exertion. Hence the gastrocnemius, or its tendon; the quadriceps femoris, just above the patella, of which I have seen two instances—the biceps and triceps of the arm; the former giving way above, in its long head, or below, at its insertion, the latter muscle or tendon rupturing just above its insertion into the olecranon. More rarely, the deltoid or the pectoral muscle yields, the rectus abdominis, or the muscles of the back.

The *symptoms* are generally well marked; sudden pain and powerlessness, with a sensation as if something had given way, and perhaps an

audible snap. Pain is far less acute if a tendon be ruptured. An interval may be discovered in the situation of rupture, into which the finger will fall when passed over the surface; a hard swelling above and below is also felt—the retracted muscle, if its substance be the seat of rupture. Subsequently, this state of the part is obscured as inflammatory swelling supervenes, or reparative lymph occupies the interval between the ruptured ends of muscle or tendon. Some discoloration may accompany the former change, or any extravasation of blood incident to the injury.

*Causes.*—Muscular contraction is the immediate cause of rupture far more frequently than external violence. Age predisposes, by reducing the elasticity of muscular texture in common with that of all textures. Rupture, therefore, occurs most frequently in persons of middle life, and who are sometimes wont to undertake feats of sudden exertion beyond their strength, in running, jumping, dancing, or lifting a weight. Degenerative changes will also predispose; and thus the rectus abdominis muscle has been found to have undergone fatty degeneration in some cases of its rupture.

I am not aware of any such predisposing conditions having been noticed in connexion with the rupture of tendons.

*Course, and Terminations.*—(1) *Reparation* ensues, and readily, in most cases. It has been traced by Paget and Adams in rabbits, and by the latter observer in the human subject. The process is the same, essentially, and alike after subcutaneous division or rupture, as follows:—

Separation of the ruptured extremities of a *tendon*,—*e.g.* tendo-Achillis, takes place to a very variable extent; in an adult, from one to two inches, in an infant, about half an inch. The upper portion is drawn upwards, proportionately to the contractile power and contraction of the muscle, and the lower portion is drawn downwards, proportionately to the mobility of the ankle-joint and position of the foot. Similar or analogous circumstances limit the separation of the divided extremities of tendon in all cases. The separated ends still remain indirectly connected with each other through the medium of the cellular sheath of the tendon, which remains almost intact, as a tubular sheath. Blood, in very small quantity, is generally effused within the sheath, and adheres to the upper and lower extremity of the tendon, principally to the upper. But if the blood be sufficient to fill the sheath and infiltrate the surrounding tissues, reparation is retarded, and rendered proportionately less perfect. It is an unfavourable incident. Increased vascularity of the sheath marks the commencement of the true reparative process; this vascularity extending to the subcutaneous cellular tissue and fat. Reparative blastema is effused into the meshes of the cellular sheath, as a matrix, which thus becomes succulent, as well as vascular; the infiltration may also extend into the surrounding cellular texture, and obscure the gap in the divided tendon. This blastema is developed into fibres, through the medium of oval nuclei; unlike inflammatory lymph in open wounds, which is developed into fibres through nucleated cells, transition forms being found in the shape of elongated cell-fibres. The nucleated blastema would seem to undergo transition by elongation of the oval nuclei, and their arrangement in parallel linear series; thus presenting a fibrillated, and ultimately more distinctly fibrous appearance, under the microscope. Capillary blood-vessels are formed in the connective tissue thus produced, and concurrently with the process of its development.

The divided ends of the old tendon take no active part whatever in the reparative process during its earlier stage, and have but slight connexion with the new material when first formed. A little later, their square surfaces and sharp edges become somewhat rounded, and their substance somewhat softened. Enlarging, and evincing a disposition to split; thin streaks of new material, greyish and translucent, are interposed; indicating the commencement of junction between the old and new tissues. The bulbous enlargement of the old tendon-ends, occasioned by the increasing interposition of new material, gradually subsides; until they regain their former appearance, and the new and old tendon become of uniform diameter. The appearance of fine dovetailing long remains, being distinctly traceable a year and a half, and three years, after division of the tendon. Complete and firm junction of the new with the old tendon is established; a want of definition along the deep surface of the new tendon, remaining permanently, owing to adhesion between this surface of the tendon and the deep fascia. Re-formation of a separable sheath on the surface of the new tendon, completes the process of reparation.

The new tendon, homogeneous rather than fibrous in appearance, is at first vascular and ruddy, but afterwards greyish and translucent; an appearance contrasting with the old tendon, above and below, and which is retained up to the latest period of examination hitherto made in the human subject, or three years after operation. Considerable toughness and strength is soon acquired; in the tendo-Achillis of a rabbit, six days after its division, a weight of 20 lbs. was required to rupture it, and after the lapse of ten days, the rupturing weight had increased to 56 lbs. A linear cicatrix is supposed by Mr. Tamplin, and other observers, to be the ultimate remnant of the bond of union; but, according to Mr. Adams' observations, this appearance is deceptive, the connective tissue or new tendon remaining permanently, during life. The greatest *length* of new tendon formed in the human subject, is apparently, as Mr. Adams states, two inches and a quarter; and this was found in the tendo-Achillis of a girl, aged nine years, a year and a half after tenotomy.

Divided *muscles* undergo, essentially, the same process of reparation, union by a fibro-cellular bond.

*Treatment.*—Rest is of course requisite for union to take place; but attention to position by relaxation of the muscle or tendon, and the maintenance of that position, are equally necessary, the structure being not merely strained or stretched, but divided. These indications of treatment are well illustrated by the treatment of rupture of the *tendo-Achillis*. The leg is flexed, and the heel drawn up, by means of a band attached to the shoe behind, and

FIG. 50.





fastened to a belt around the lower part of the thigh. (Fig. 50.) If the relaxed position be disregarded, the uniting bond will inevitably be elongated and weak. With this result, antagonistic muscles may afterwards occasion considerable deformity by their continued and inadequately opposed contraction. Talipes varus—after operation and premature removal of the splint—may thus become slowly converted into the opposite deformity,—talipes valgus. Hence also the newly united muscle or tendon should be exercised very gradually and cautiously.

(2) *Imperfect and non-union of Tendon.*—Various causes lead to these results.

*Imperfect union* of the tendo-Achillis, for example, may arise from, some constitutional defect in the reparative powers of the individual, or from depressed vital power in the limb, owing to paralysis. Injudicious after-treatment, from ;—not sustaining the temperature of the limb, especially in paralytic cases during very cold weather ; too early and too rapid mechanical extension ; too early exercise of the part.

*Non-union* is specially liable to arise, when tendons are situated in dense tubular sheaths ; the divided ends of tendon becoming adherent to the inner surface of the sheath, but not having any direct connexion with each other.

*Treatment.*—Any of the causes of imperfect, or non-union, must be avoided or corrected. With respect to mechanical extension, after operations for deformity ; Mr. Adams does not consider it necessary to make extension gradually, for the purpose of stretching the new tendon, the requisite length of which should be obtained during the period occupied in its formation, ordinarily, two or three weeks ; but gradual extension is necessary, either to overcome ligamentous resistance, or to prevent a too rapid and excessive separation of the divided ends, and thus regulate the length of new tendon produced. The liability to non-union may be avoided, by never dividing a tendon in its course through the denser portions of its sheath, and when the operation is performed near to such parts, extension should be conducted very gradually.

Certain operations have been practised to induce the reparation of an ununited tendon. Paring the ends and joining them by suture will seldom prove satisfactory. Subcutaneous puncture, as for ununited fracture, has proved successful in some cases.

**DISPLACEMENT OF TENDON** may occur. The tendon of the tibialis posticus muscle, occasionally slips out of its groove, with instant pain and lameness. The long tendon of the biceps flexor cubiti is sometimes tilted out of its groove. Such mishaps generally rectify themselves, the tendon slipping in again ; or replacement can be readily accomplished by a little manipulation.

**INFLAMMATION OF MUSCLE.**—Rare as a primary disease, the muscles may be involved by the extension of Inflammation from adjacent structures. Rheumatic inflammation of the muscles is probably of this kind, affecting primarily the investing aponeuroses. Syphilitic inflammatory indurations of muscle are also said to occur.

A notable instance of inflammatory extension I once saw ; peritonitis extending to inflammation of the abdominal recti muscles, which after death presented a quagmire of slough and pus. Immediately behind the sheath of these muscles, and near the umbilicus, lay the vermiform appendix of the cæcum, which contained a bean. It was, apparently, a grand effort of Nature to discharge this impacted foreign body.

The *treatment* of muscular inflammation must be conducted on general principles, having reference to the apparent causes in operation.

**TUMOURS OF MUSCLE**—Equally rare, perhaps, as primary diseases, the muscles are yet sometimes the seat of Morbid Growths. The reader is referred to the distribution of Morbid Growths, for some such particulars. But, Mr. Teevan has collected 62 cases of tumours of muscles. About one-third were *cancerous*; 16 *fibrous*; 8 *cystic*; 5 *hydatid*; and 5 *erectile*. Mr. Erichsen has seen 7 cases of tumours “primarily” formed in muscles. In 1 case, a fibro-cystic tumour, as large as a cocoa-nut, was “developed in connexion with the tensor vaginæ muscle;” in 1 case, a cystic tumour, the size of a foetal head, developed in the substance of the adductor brevis of the thigh; in 1 case, a *fibro-plastic* tumour, the size of a child’s head, formed within the sheath and in the substance of the sartorius muscle of the left thigh; in 1 case, another cystic tumour, about as large as a goose’s egg, springing from the flexor brevis digitorum. Encephaloid cancer formed in the cicatrix, and springing from the muscle just named, showed the nature of the original tumour. In two cases, the tumours were hydatid; one in the deltoid, the other at the outer edge of the latissimus dorsi. In the 7th case, the tumour was an *enchondroma* in the tibialis anticus muscle. In one other case, enchondroma was situated in the vastus-externus; and in yet another, it was connected with the pectoral muscle.

The muscles of the lower limb are most frequently the seats of tumours; in the upper limb, according to Mr. Teevan, the muscles usually, are the pectoralis major, deltoid, and biceps. Those of the neck and trunk are seldom diseased, excepting the rectus abdominis muscle, a frequent seat of tumours.

The *treatment* of muscular tumours differs in no way from that of the same growths situated in other parts of the body. Excision and amputation are the only known resources.

**DEGENERATION of Muscles**—see General Pathology and Treatment of Degeneration.

## BURSÆ AND SHEATHS OF TENDONS.

### CHAPTER XXI.

#### INFLAMMATION.—GANGLION.

**BURSÆ MUCOSÆ. SYNOVIAL BURSÆ.**—The bursæ are synovial sacs, resembling other synovial membranes, and differing only in situation. They are interposed—to facilitate motion—between the surfaces of parts which naturally move on each other. Thus, they are situated, normally, as sub-cutaneous bursæ, in the cellular texture between the skin and some firm prominence—*e.g.*, the bursæ over the patella; or deep-seated, between a muscle or its tendon and bone, or between two muscles or tendons, and not unfrequently communicating with a neighbouring joint. Subcutaneous bursæ may be adventitious, resulting from enlargement of the areolæ in the cellular texture by continued friction; as beneath corns, bunions, the prominent points of club-foot, and other exposed situations. Such bursæ

are, however, imperfect; spaces being thus formed in the cellular texture, rather than bounded by any true synovial membrane.

*Situations of Normal Bursæ.*—In the following situation, bursæ exist naturally, and are subject, therefore, to injury or disease:—behind the angle of the lower jaw, on the symphysis of the chin, on the angle of the thyroid cartilage, on the acromion, between the lower end of the scapula and the latissimus dorsi, under the deltoid, on the external and internal condyles of the humerus, the olecranon, the styloid processes of the radius and ulna, on the metacarpo-phalangeal articulations, their dorsal and palmar surfaces, and on the dorsal aspect of the phalangeal articulations; on the anterior superior spine of the ilium, the great trochanter, the tuberosity of the ischium, and under the gluteus maximus, on the patella, on each condyle of the femur, the tuberosity of the tibia, in the ham, on the two malleoli of the tibia, the os calcis, the dorsal surface of the toes, and the plantar aspect of the heads of the first and fifth metatarsal bones.

(1) *INFLAMMATION* of a bursal sac may occur, with enlargement and distension of the sac with synovial secretion. Suppuration soon follows, and the formation of abscess, which bursts externally or into the surrounding cellular membrane. This texture is also liable to become involved as the abscess progresses. The resulting ulcerations are singularly obstinate.

(2) *Chronic enlargement* of a bursa, from long continued pressure and irritation rather than inflammation—is another condition of common occurrence. The bursa becomes distended with contents of variable nature, partly fluid and solid; as an increased sero-synovial secretion of clear straw-coloured fluid, or a brownish fluid, thick and grumous, apparently due to altered blood, or adhesive and containing cholesterine. Fibrinous matter is occasionally deposited on the interior of the sac, gradually producing considerable thickening of the wall of the sac. Within the sac, numerous small flattened and elongated bodies may form, resembling melon-seeds or parboiled rice; and which result, apparently, from disintegrated fibrinous matter subjected to motion and attrition, or from the detachment of pedunculated fibrinous matter from the interior of the sac. The origin and production of these bodies is thus similar to the formation of loose cartilages in joints, and they gradually acquire a fibro-cartilaginous character. Lastly, fibrinous deposit progressing concentrically, may at length convert the bursa into a solid tumour, having a laminated structure, or leaving a small central cavity containing a gelatinous fluid.

The *diagnostic character* of these various structural conditions is tolerably obvious. Inflammation, followed by suppuration and abscess, sloughing and ulceration; will be severally attended with their usual signs and symptoms.

Enlarged bursæ are chronic indolent tumours; with distinct fluctuation, denoting fluid contents, or having a solid resisting character according to the deposition of fibrinous matter. Thickening of the sac forms a semi-solid tumour, and the production of melon-seed-like bodies sometimes yields a crackling sensation on handling the sac, while complete solidification presents a hard elastic tumour.

*Causes.*—Some local injury, as pressure, friction, or a blow, is generally the cause, whether of inflammation or simple enlargement of a bursa. Occasionally, some constitutional tendency seems to have a predisposing, or possibly productive influence.



*Treatment.*—*Inflammation* may be subdued by rest, cold or warm fomentations, and topical bleeding. Suppuration having occurred, a free opening must be made and poulticing continued until granulation is established. *Chronic enlargement* of a bursa yields to various methods of treatment according to the nature of its contents. An accumulation of serous fluid in the sac may be absorbed by a stimulating application, such as iodine paint, which I prefer. By puncturing the sac and pressure, or by the injection of iodine, adhesion may be induced; or the introduction of a seton for a few days may lead to suppuration and contraction.

Fibrinous matter having been deposited, thickening of the sac, and an accumulation of melon-seed bodies within its interior, may possibly be cured by a seton, inducing discharge and contraction. But this condition, or that of complete solidification, generally necessitates removal of the bursa surgically. When fairly dissected out, the disease can never return, and commonly no evil consequences follow this operation. In one case only, after I had thus extirpated an old enlarged bursa patellæ, phagedænic gangrene appeared in the wound, and spread to some distance above and below the knee. But this was, evidently, an accidental concurrence, and no valid objection to the method of treatment.

**PARTICULAR BURSAE.**—*Bursa Patellæ.*—The bursa situated over the patellæ is liable to the same diseases as those common to all bursæ. *Inflammation* and its consequences, or simple chronic enlargement, not unfrequently occur. "Housemaid's knee," as it is called, is an inflammatory affection of the bursa patellæ; arising from frequent pressure and irritation by kneeling on a hard surface. But the same condition may be produced in other females and in males, under similar circumstances.

*Caries* of the patella—consequent on abscess of the bursa—possibly involving the knee-joint eventually; seems to be the only pathological peculiarity worthy of notice in connexion with this disease.

The *treatment* is the same as that of bursal affections in general; the treatment of inflammation and suppuration; or, in a chronic state, stimulating applications, puncture and pressure, injection, a seton, or extirpation by careful dissection, having regard to the proximity of the joint to the enlarged bursa.

*Bunion.*—Inflammatory enlargement of the bursa situated on the inner aspect of the metatarsal bone of the great toe, or of an adventitious bursa formed in that situation, is the essential element of a bunion. The sac contains an increased quantity of thin serous fluid, or a dense crystalline secretion occasionally, as observed by Sir B. Brodie and M. Boyer. Over this enlarged bursa, a corresponding portion of thickened and horny cuticle, a large corn forms; both of which constitute the bunion. (Fig. 51.) The toe is generally displaced obliquely outwards, lying over or under the adjoining toes; thus forming an angle more or less obtuse at the metatarso-phalangeal articulation, or root of the great toe, and considerably increasing the prominence inwards. Acute pain, redness and heat—the symptoms of inflammation—accompany this swelling; it being partly an inflammatory enlargement of the bursa.

FIG. 51.



*Chronic bunion* represents the result of this state, inflammation having subsided into a tolerably painless enlargement of the bursa; but which is liable to become acute, occasionally.

The *cause* of this condition is the pressure of a tight and narrow-pointed boot or shoe, habitually worn; whereby the toe gradually becomes turned outwards from its natural direction, increasing the pressure on the root of the toe projecting inwards. The formation of bunion is, therefore, mostly secondary to, and the consequence of, this displacement of the toe. Continued and increasing pressure thus bearing on the root of the toe, the bursa there situated enlarges or a new one is produced, and the superimposed cuticle becomes a corn.

The *course* of bunion is apt to be very destructive. The internal lateral ligament yields under the constant strain, suppuration within the bursal sac frequently supervenes, the abscess slowly progressing to the surface and opening by a small circular aperture in the centre of the horny callosity; or destroying the ligament and involving the joint; the cartilages are eroded, the bones become carious, and partial dislocation inwards is permanently established.

Some relief of the intolerable pain and of the other inflammatory symptoms, follows any evacuation of matter; but an indolent and unhealthy sore remains, indisposed to heal.

*Treatment.*—Removal of the cause in operation is primarily important. A large shoe should be worn, or one with a compartment for the great toe, so as to keep the toe in a line with the metatarsal bone, and thus relieve pressure. By a contrivance of Mr. Bigg, the toe can be drawn inwards. A compress of thick soft leather, spread with soap-plaster, and cut in the form of a horse-shoe, or a circular piece with a hole in the middle, may be applied; the opening corresponding to the bunion, which is thus relieved from pressure. Inflammation is to be overcome by the usual topical applications: poulticing or cold lotions according to the state of the bunion. Abscess forming in the bursa, an opening should be made without delay, both to relieve the intense pain and prevent any destruction of the joint.

*Chronic bunion* is best removed by painting it with a strong solution of nitrate of silver. A large, and perhaps painful cyst, may be destroyed, as recommended by Sir B. Brodie and M. Boyer, by an incision into the sac, and cauterizing its inner surface with nitrate of silver or nitric acid. It should be observed whether the sac communicates with the joint. Destruction of the internal lateral ligament, and the articulation, may terminate well, by fixing the joint with a gutta-percha splint; or this condition may necessitate excision or amputation of the toe. The latter operation has been resorted to successfully, in some cases.

*SHEATHS OF TENDONS.*—(1) *Tenosynovitis—acute and chronic.*—Sheaths of tendons in the neighbourhood of joints, are most liable to inflammation. The flexor and extensor tendons of the wrist, for example, are subject to strains in various laborious occupations. To guard against any such injury, it is not uncommon for navigators and others similarly employed, to wear a band around the wrist, as a support to the tendons.

Puffy swelling and some pain in the course of tendons, after injury, denote inflammation of their sheaths. A peculiar creaking, jerking, sensation and sound, is elicited on moving the part. This latter sign differs from the true crepitus of fracture.

The *treatment* is in no way peculiar. Rest, and warm fomentations;

followed by stimulant applications and pressure in the chronic state of inflammation. Blistering, embrocations, and a bandage are thus efficacious; or the emplastrum ammoniacum cum hydrargyro employed as strapping, is both stimulating and supporting to the part affected.

(2) *Ganglion*.—This is a simple or barren cyst or sac, attached to, but communicating with, a sheath of a tendon. It contains a firm, transparent whitish, gelatinous matter, resembling the vitreous humour of the eye. The cyst varies in size and shape, from a pea to a filbert; and presents a corresponding tumour, smooth, elastic, moveable, and subcutaneous; situated usually on the back of the wrist, occasionally on the dorsum of the foot. This little tumour is itself painless, even when pressed firmly under the thumb, although the patient experiences a sense of weakness in the joint.

*Chronic ganglion* does not so much increase in size, as the cyst attains considerable thickness and resistance. Arising from a sprain, or as it were spontaneously—unlike a subcutaneous bursa which proceeds from pressure—ganglion is usually of slow growth, but, sometimes, makes its appearance quite suddenly.

*Compound Ganglion* is described by Erichsen, as a dilatation of the sheaths of the tendons; often attaining a very considerable size, and usually becoming irregular in shape, several tendons being implicated in it. Often the sheath is thickened as well as dilated, and highly vascular, being lined with a red, fringed, and velvety membrane; the contained fluid is clear and yellowish, but usually thinner than in simple ganglion; or the fluid may be dark and bloody, containing masses of buff-coloured fibrine or a large number of granular bodies, like those met with in enlarged bursæ. “These bodies are composed of perfectly developed granulations, in which the remains of blood-vessels are visible, probably thrown off from the inner wall of the vascular sheath.” Compound ganglion is chiefly met with in the palm of the hand, and on the dorsum, sole, or inner side of the foot. This form of the disease is extremely *chronic*, may acquire an almost malignant appearance, and occupy a very extensive surface; in one case, the dorsum and greater part of the inner side of the foot were involved. Simple ganglion, however, in this situation is larger, flatter, and less moveable than on the back of the wrist. In some instances, Mr. Tatum has seen such a ganglion, on the outer part of the back of the foot, more than two inches in diameter and compressed.

*Treatment*.—*Simple ganglion* is, usually, amenable to remedial measures. In its ordinary situation, on the back of the wrist, a ganglion may be dispersed by squeezing it with the thumbs, or by a blow with the back of a book; the sac bursting and evacuating its contents under the skin. A *chronic ganglion*, having a thickened sac, may require considerable pressure before it yields, and the sac remaining may still give the appearance of a ganglion; deceiving both the operator and the patient, unless the sensation of bursting be noticed during the application of pressure. Sometimes, the cyst refills, and it may be necessary to continue pressure by means of a compress and roller, firmly applied. Occasionally also, other measures as for an enlarged bursa, are requisite; puncture and pressure, a seton, or extirpation by dissection.

*Compound ganglion*—distension of the sheaths of tendons—is a far more obstinate disease; especially, when occurring in its usual situation, the palm of the hand. The sheaths of the flexor tendons are distended, containing a glairy or other fluid. The elastic tumour, thus formed,



beneath the palmar fascia, extends under the transverse ligament into the forearm, in the form of a double swelling, constricted by the ligament. The fingers are contracted. The treatment by free incision of the tumour, dividing the annular ligament, and healing from within, as recommended by Syme, may be advisable, although apparently an extreme measure. But other proceedings; the passage of a seton from above under the annular ligament into the palm, or the injection of iodine, are more hazardous, as methods of treatment by inducing inflammation.

## NERVES.

### CHAPTER XXII.

#### INJURIES.—NEURITIS.—NEURALGIA.

**INJURIES.**—Nerves are seldom injured alone, but in connexion with other textures, the injury being shared in common with them. Nerves are, however, liable to similar lesions as other soft textures; wounds, incised, punctured, and contused, and to contusion without breach of continuity. Perhaps, the latter lesion is the most frequent, as when the ulnar nerve at the elbow is contused by an accidental collision, just catching the nerve in its course between the inner condyle and olecranon.

The symptoms attending these forms of injury vary with the amount of injury to the nerve, and its own functional importance. Pain, tingling or other perverted sensation, accompany contusion; complete paralysis of sensation, and of motion, in the parts supplied by the nerve, denote division. This has happened in excision of the elbow-joint; division of the ulnar occasioning immediate loss of sensation on both sides of the little finger and inside of the ring finger, with inability also to move these fingers. Sometimes, loss of temperature, and failure of nutrition supervene; owing probably to the loss of nervous influence on the circulation in the part to which the nerve is distributed.

Fortunately, restoration after contusion, and reunion, after division, not unfrequently take place; the nerve sooner or later resuming its functions.

The *treatment* will, therefore, be guided by these considerations. Rest in all cases, and apposition of the ends, if the nerve be divided.

**NEURITIS.**—Inflammation of Nerve.—*Symptoms.*—Pain, severe and continued, shooting along the nerve or nerves affected; and rendered intolerable by pressure in their course, or on attempting to move the part. Jerking of the muscles often occurs. Some heat and swelling along the course of the nerve may perhaps be detected, if the inflamed nerve be situated near the surface. Marked inflammatory fever is present in all cases. *Chronic* neuritis is attended with a subsidence of all these symptoms, leaving the nerve still sensitive, and sometimes painful; and the individual worn out by suffering and sleeplessness.

*Causes.*—Usually arising from injury; the various lesions to which nerves are liable may induce inflammation, extending along the sheath of the injured nerve. But neuritis may also proceed from some blood-poison, of which it is the local, or one of the local, manifestations.

Sciatica is probably a manifestation of this kind; a rheumatic inflammation of the sciatic nerve.

*Treatment.*—Local blood-letting and warm fomentations are most suitable in neuritis of traumatic origin. Rheumatic neuritis must be treated, locally and constitutionally, as acute or chronic rheumatism.

NEURALGIA.—*Symptoms, and Diagnosis.*—Pain is still the essential symptom as in neuritis. It may be even more severe, or excruciating, but it is paroxysmal; shooting along the course of a nerve, or diffused, but commonly relieved by firm pressure, although generally induced by the slightest superficial touch or movement of the part. Various anomalous sensations may be experienced, as creeping, tickling, or burning in the part. Spasm of the muscles is a frequent concomitant. Slight heat, puffiness, and redness may supervene, and increased secretion, as of tears or saliva when the nerves of the eye or jaw are affected. But no fever of an inflammatory character accompanies the attack. Its duration is usually much shorter than neuritis; lasting perhaps only a few minutes, although prolonged indefinitely in some cases. The periodical return of neuralgia, at a certain time in the day, or in certain months of the year, is also characteristically distinctive.

From structural disease of the part, neuralgia is distinguished by the absence of any special physical signs—*e.g.*, inflammatory swelling, and of fever; and also by the character and disproportionate severity of the pain. From hysterical pain, it differs in mostly being restricted to one part, and by the absence of general hysterical symptoms.

The association of structural disease with neuralgia is sometimes most perplexing. But here—and with regard to hysteric pain—the diagnosis may be determined by the aggravation of the pain by deep pressure, rather than any marked cutaneous sensibility. The mistaking structural disease for neuralgia, would mislead the treatment; but this error is not so seriously misleading as the mistaking neuralgic pain for structural disease. By attention to the foregoing points of distinction, the line may generally be safely drawn between neuralgia and disease of the joints, the breast, testicle, and other parts.

Certain nerves are more frequently the seat of neuralgic pain. The divisions of the fifth pair are specially liable; and in particular the supra-orbital branch. But neuralgia may occur in perhaps any part of the body; in the scalp, ear, nose, back of the neck, the back, chest, abdomen, arms, ball of the thumb, legs, feet.

*Causes.*—*Constitutional* conditions, mostly of an obscure character, seem to be the essential cause of all this suffering. A generally depressed state of the nervous system, and circulation of the blood, may be said to represent the constitutionally causative condition, usually apparent. Thus, constant exposure to wet and cold, the climatic influence of damp localities, or periods of the year, depressing passions, not unfrequently induce neuralgic attacks in persons previously healthy. Certain blood-poisons are less obvious, but not less potent. The malarious poison of marshy districts, is thus sometimes the source of the most severe and persistent neuralgia. Chlorosis from amenorrhœa is another such cause. The influence of blood-conditions may be even more conspicuous, in albuminuria; a disease in the course of which, I have witnessed neuralgic attacks of more intense agony, than in any other disease. *Local* irritation is often the immediate and exciting cause. A carious tooth, or piece of dead bone elsewhere, the accumulation of scybalous matter in the

intestinal canal, or other sources of irritation, centric or eccentric, are causes of this kind. The pressure of a tumour in the course of a nerve, or a neuromatous tumour itself, would sometimes appear to be causes of neuralgia; but any injury to, or disease of the nervous system, is in this sense causative. Dr. Pemberton suffered for many years from excruciating pains in his face, to relieve which, Sir A. Cooper severed the three divisions of the fifth nerve, on different occasions, without avail. Driven from practice, and worn out by protracted suffering, at length death brought that release which art had failed to give. A tumour was then found in the brain; and thence the origin and persistency of the pain endured during life. Similar instances of *sympathetic pain* are cited in the work on "Principles," p. 674.

*Course and Terminations.*—Neuralgia is as uncertain in its subsequent history, as its pathology and etiology are obscure. The attacks may cease suddenly, leaving the individual in apparently good health, or soon to recover from the temporary exhaustion consequent on pain and sleeplessness. Or the sufferer at length succumbs, dying from sheer exhaustion.

*Treatment.*—The cause or causes in operation must be diligently sought for, in each case. It will be useless, however tempting, to remove a merely local cause, when the constitutional condition is still in operation. A change of residence from a damp or malarious locality, may thus be necessary. Other depressing circumstances already noticed, are less under control. *Medicinal* treatment may, however, do something, preventive or curative. Quinine, in large doses—two, three, five grains, or more, will sometimes ward off an attack or cut it short. Quinine treatment continued in smaller doses, sometimes proves curative. Preparations of iron, the sulphate in particular, are more effectual in neuralgia of malarious origin. In albuminuria the blood restorative action of iron, is counteracted by the constant retention of urea and other excrementitious matters in the blood. Disordered menstruation must be remedied by the administration of emmenagogues—*e.g.*, galbanum, myrrh, &c., in conjunction with tonic treatment. Constipation or irregular action of the bowels, by aperients, chosen according to the occasion. Thus, aloetic purgatives, rhubarb, mercurials, and salines, are all useful, in different cases.

Any *local* cause of irritation must not be overlooked, but its removal will seldom overcome a true neuralgic tendency. The extraction of a carious tooth, for example, seems only to divert the recurrence of pain to another, and possibly sounder tooth. Local applications—sedative or counter-irritant—are comparatively useless. Belladonna, opium, aconitina, and other powerful sedatives have been tried in vain. The hypodermic injection of morphia is, perhaps, more promising. Blistering, or instilment embrocations, will rarely be tolerated by the patient.

*Section of the nerve* is a last resource. It cannot succeed in cases of neuralgic pain depending on pressure in the course of a nerve, unless the occasion of pressure can be detected, and the operation be performed above that part. It was thus unavailing in the case of Dr. Pemberton. When appropriate, the section must be an *excision* of a portion of the nerve, the simply divided ends otherwise regaining their continuity.

NEUROMATOUS TUMOUR.—See Morbid Growths.



## ARTERIES.

## CHAPTER XXIII.

## INJURIES OF ARTERIES.—ANEURISM.

WOUNDS—and of SPECIAL ARTERIES.—These Injuries are conveniently associated, respectively, with WOUNDS in general (Ch. XIV.); and with TRAUMATIC ANEURISMS in various parts of the body. (Ch. xxiv.)

ANEURISM.—*Structural Conditions.*

—Aneurism may be generally defined to be a collection of arterial blood communicating with an artery, from which it has arisen. (Fig. 52.)

This collection of blood may be *circumscribed*, commonly, by enclosure within a dilated portion of the artery, as a sac, forming *true aneurism*; or possibly within a sacculated dilatation of its external cellular coat alone, the internal and middle coats having become ruptured—*mixed aneurism*; or, the blood may become enclosed within condensed cellular texture of the part, external to but adjoining that of the artery, thus forming a sac enclosing blood, and constituting circumscribed *false aneurism*; or, the blood having escaped from the artery into the adjoining cellular texture, may remain diffused therein, constituting *diffused false aneurism*. Whether this condition shall remain, or form a *circumscribed false aneurism*, will depend chiefly on the degree of looseness or density of the surrounding cellular texture, on the size of the artery, and the direction of the opening in it; and, moreover, is regulated by the force and rapidity of the current of blood passing through the vessel. The accompanying figure represents a diffused aneurism becoming circumscribed. (Fig. 53.)

Other forms of Aneurism are recognised by Surgical Authors. *Fusiform* or *Tubular Aneurism*, is a dilatation of all the coats of an artery, extending throughout the entire cir-

FIG. 52.



FIG. 53.



cumference of the vessel, and not forming a sac. It commonly occurs in the arch of the aorta. *Dissecting* aneurism, is sacculated, but the sac is formed between the coats of the artery, and generally between the internal and middle coats, which have become separated or dissected up by the force of the blood, the inner coat having given way. The sac thus situated may extend a considerable distance along the vessel. This condition was first described by Shekelton.

**SIGNS.**—The physical signs of aneurism vary with its condition. *True* aneurism at first presents a small, soft, circumscribed tumour, pulsating, to the touch, to the eye, and to the ear,—as a rasping or sawing sound or bruit,—in unison with each beat of the heart. The pulsation ceases and the tumour itself subsides, if the current of blood through the aneurismal sac be arrested by compressing the artery above the aneurism. And, at this early period, the sac can be emptied by pressure, and the blood thus returned into the artery.

*Mixed*, and *circumscribed false* aneurism, respectively, are not characterized by any peculiar signs; either of these forms of aneurism presenting a circumscribed tumour, and in its early stage, beating and thrilling under the finger, yet being also reducible.

Seeing then that the signs of these three forms of aneurism are indistinguishable, their distinctive names are *practically* useless. In the course of time, the aneurismal sac, enlarging and borrowing more and more fibrine from the passing stream of blood, becomes partially consolidated. The tumour, as felt externally, is, therefore, no longer soft, although still circumscribed; its pulsations are fainter and less expansive, and the swelling cannot be reduced by compressing the vessel above, nor by direct pressure without such force as would break up the clot. The sound or *bruit* also, produced by the pulse-wave of blood through the aneurism, may now be absent; as when the neck of the sac is too narrow to readily admit the current of blood into the sac, or if the sac be consolidated with coagulum. Hence, the characteristic signs of aneurism are modified or absent.

*Diffused* false aneurism, in virtue of its essentially distinctive condition from that of any circumscribed aneurism, might be designated simply,—Diffused Aneurism. The tumour is generally of much larger size than a circumscribed aneurism; its outline is no longer defined, the pulsations are fainter and more indistinct or quite imperceptible; and the blood, being infiltrated, cannot be returned into the aneurismal artery. The swelling resembles a large ecchymosis, the superjacent integuments being discoloured like an extensive bruise. The limb or part dependent on the artery for a due supply of arterial blood, becomes cold and œdematous, threatening gangrene. If the diffused form be *consequent* on circumscribed aneurism, the individual felt something give way suddenly, followed immediately by notable enlargement of the aneurismal swelling; accompanied with intense pain and faintness. The former symptom is due to pressure from the diffusion of blood among the textures and possibly under unyielding fasciæ: the latter symptom arises partly from shock, by the pain thus caused, and partly from the loss of blood in circulation, by its effusion.

The *functional* symptoms of aneurism, are, pain, loss of muscular power, and venous congestion. These do not occur until a rather late period of aneurism, and do not accompany it throughout its career. They, therefore, are neither primary nor constant manifestations, and are inapplicable in aid of an early and exact diagnosis. [P. p. 173].

**DIAGNOSIS.**—The *physical* signs of aneurism, already described, may themselves be absent; as when consolidation in the sac has taken place. Or, if these signs be *present*, they may arise from other causes, other *pulsating* tumours. Such are, vascular or erectile tumours, and certain tumours of a highly vascular character, as encephaloid cancer. The diagnosis will be determined by comparing the signs of these Tumours with those of Aneurism. Then again, a tumour or an abscess seated on an artery, pulsates, and thus simulates aneurism. But, the pulsation of any superimposed mass is not expansive and uniform over its whole surface; the tumour does not subside if pressure be made on the artery above, although the pulsation ceases; and it cannot be emptied by direct pressure. It should, however, be remembered that these negative signs are equally true of aneurism which has undergone consolidation. In some doubtful cases, the tumour can be lifted off the artery; thus plainly declaring its independence. There are also frequently present the characteristic signs of the particular kind of tumour or swelling.

*Diffused* aneurism is far less likely to be equivocal, its signs being more peculiar.

The *history* of aneurism will further aid in determining its diagnosis. If the tumour be circumscribed, by conversion from diffused aneurism; there will be the antecedent transition changes from *that* condition. If diffused, by conversion from circumscribed aneurism, there will be antecedent transition changes from *that* condition; if originally diffused, there will be the antecedent fact of traumatic origin.

**CAUSES, AND EFFECTS OF ANEURISM.**—Aneurism commonly arises from an *internal* cause; namely, a diseased or atheromatous condition of the artery, by fatty degeneration—oil-particles, with crystals of cholesterine (Fig. 54), and subsequently calcareous degeneration; affecting the middle

FIG. 54.

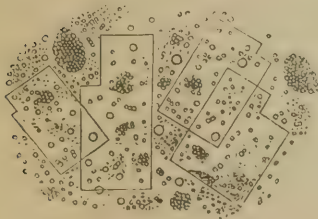


FIG. 55.\*



or muscular coat of the vessel (Fig. 55). In the fatty or atheromatous stage of degeneration the inner aspect of the artery presents slightly elevated patches, yellowish and opaque—underneath the thin inner membranous coat; then, in the calcareous stage, it becomes inelastic and brittle, and the patches assume the character of bony plates—consisting of mineral salts—the phosphate and carbonate of lime, but having little or no osseous structure; lastly, the inner coat or lining membrane gives way, or disappears. The degenerate portion of artery

\* Fatty degeneration of cerebral arteries; a, ultimate capillary; b, larger vessel; c, small artery. (Wedl.)



having lost its elasticity, and perhaps being partially ruptured, is disposed to yield to the pulsating action of the arterial wave-current, and expand into an aneurismal sac. Hence, the formation of *idiopathic* Aneurism, which is primarily circumscribed, and secondarily only becomes diffused, by rupture; or eventually perhaps again circumscribed, by fibrinous consolidation.

The *number* of aneurisms which are liable to form, simultaneously or successively, in the same individual, is mainly determined by the nature of the internal cause in operation. Fatty and calcareous degeneration not unfrequently affects a large extent of an artery, as the aorta, or many arteries, as both popliteals and other vessels. Thence the production of more than one, and even numerous aneurisms in the same person. Sixty-three, for example, were found in one individual, whose body was examined by Pelletan.

*Predisposing* Causes, vary in their nature and degree of influence. *Age* is important, but apparently only as connected with those degenerative changes which the arteries, in common with many other textures, undergo as life advances. Thus, aneurism is most common about the middle period of life, or between the ages of thirty and forty, and subsequently. Certain *blood-diseases* seem to have some predisposing influence. Syphilis, gout and rheumatism, have this reputation. *Climate* appears to possess an inexplicable predisposition; aneurism being far more common in cold than in hot countries. The immunity of the East Indies contrasts favourably with the climate of Great Britain and Ireland. *Occupation* has an unquestionably important influence, and especially in connexion with previous habits of life. Thus, any violent exertion, and by persons who are habitually sedentary, is conducive to aneurism. Hunting, pedestrianism, and other athletic sports, may therefore have this tendency. Such pursuits seem to favour the production of aneurism, by repeatedly exciting a powerful action of the heart and compression of the arteries, in muscular exertion. *Sex* is thus associated with predisposing causes; aneurism occurring more frequently in men than women, in about the proportion of 7 to 1. But, the influence of this and other sources of predisposition, is very variable, and undetermined with regard to their causative importance.

The *external* causes of aneurism are injuries of various kinds affecting the arteries; as, an external wound, a fracture or dislocation, opening an artery; or, a strain, or bruise, inducing sloughing of the vessel. Hence the formation of *traumatic* Aneurism; which is primarily diffused, and secondarily only becomes circumscribed, in favourable cases.

It appears then, that Aneurism arising idiopathically or traumatically, may, respectively, be found either circumscribed or diffused; and conversely, Aneurism, in either of these structural conditions, may, respectively, have arisen idiopathically or traumatically.

These relations of origin and structural condition, in respect to Aneurism, are clearly represented in the following Table:—

#### ANEURISM.

Origin.	{	Idiopathic	{	Circumscribed—primarily.
			{	Diffused—secondarily.
	{	Traumatic	{	Diffused—primarily.
			{	Circumscribed—secondarily.

The *mode* of origin in no way affects the signs and the diagnosis of

Aneurism, here the structural conditions, circumscribed and diffused, are the grounds of distinction ; but the etiology of Aneurism affords the most significant indications as to treatment. This will appear presently. While, therefore, I recognise the perceptible distinctions, circumscribed and diffused Aneurism, I would supplement this diagnosis, by associating therewith that condition of the artery, whether of disease or injury, which is suggested by the origin of the aneurism, as idiopathic or traumatic.

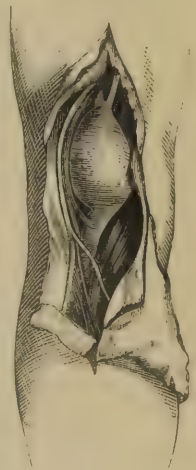
The *effects* of Aneurism, as an internal cause, are both local and constitutional.

*Locally ; circumscribed* Aneurism produces pressure-effects. The sac of blood, fluid or semi-solid, pulsating and gradually enlarging, exerts a constant, expansive and increasing circumferential pressure ; producing various functional disturbances and alterations of structure in surrounding parts, as exhibited by the pressure-effects of popliteal aneurism (Fig. 56). The current of blood, through the artery, being more and more obstructed, or altogether intercepted, the veins are turgid, and œdema supervenes. The nerves become flattened into ribands, occasioning intense pain, or eventually, partial paralysis ; the muscles waste, and the bones erode, without, however, the accompanying formation of pus, as in caries. The bursting of circumscribed aneurism and its conversion into the diffused condition, takes place in two ways. By *sloughing* and rupture of the skin, or of the mucous membrane in certain internal aneurisms ; or, by *fissure* of a serous membrane, if the aneurism burst into the peritonæum, the pleura, or pericardium. The hæmorrhage externally or internally, may be, either sudden and fatal, or recur again and again, and thus at length prove fatal. With *diffused* Aneurism, the functional disturbances—consequent on the circumscribed condition—may persist, or be relieved, temporarily or permanently. Yet with progressive enlargement of the diffused tumour, other, and analogous functional disturbances and structural alteration of surrounding parts supervene. *Constitutionally ;* the operation of Aneurism varies with its structural condition. If circumscribed, the tumour may induce some degree of inflammatory or sympathetic fever, arising from the local irritation ; but this is succeeded by exhaustion, from prolonged pain and sleeplessness. If the aneurism be diffused, the same constitutional disturbances ensue ; and, when circumscribed aneurism becomes diffused, this alteration of structural condition is accompanied, as already stated, by more or less shock, which is due both to the sudden and severe pain, and to the equally sudden hæmorrhage or loss of blood in circulation.

*COURSE, AND TERMINATIONS.*—Aneurism may undergo reparation, or spontaneous cure as it is termed ; or burst, and eventually prove fatal by hæmorrhage, externally, internally, or in both directions.

(1) *Spontaneous cure.*—*Circumscribed* Aneurism is naturally disposed to undergo spontaneous cure. The *essential* nature of this process is coagulation of the blood within the aneurismal sac ; for although coagulation therein may occur naturally under four or five different contingent conditions, as *modes* of cure ; they alike tend to thus obliterate the

FIG. 56.



aneurism. The *principle* of cure will be readily understood. Aneurism arises whenever the force and velocity—the *impetus* of the blood's motion through any given artery—is no longer counterbalanced by the elasticity and contractile force—the resisting strength of the walls of that vessel. Coagulation of the blood within the aneurismal sac tends to restore this resisting strength, and is therefore proportionately conducive to the cure of aneurism. The *details* of this process, and the external *signs* of its progress, are briefly these:—The blood continuing to flow through the aneurism, leaves upon the interior of the sac a thin layer of coagulum, upon which another is superimposed, and so on, forming a lamellated coagulum—the outermost portion of which, attached to the sac, acquires considerable firmness and resisting strength. This consists of distinctly laminated fibrine. (See Fig. 52). It eventually becomes somewhat friable, and resembles boiled beef in colour. The portion of coagulum next in order has the consistence and appearance of damson-cheese; while the innermost portion—in contact with the flowing blood—is semi-fluid, like currant jelly. By this successive deposition of coagulum the sac is gradually filled up to the level of the artery; which still remaining pervious, the surface of coagulum exposed to the current of blood acquires a smooth and membranous appearance. In a large artery, through which the blood flows with most force, coagulation within the *sac alone* may be the whole extent of spontaneous cure. Its external signs are:—gradual solidification of the aneurism; less and less forcible expansion; the pulsation is that of a solid tumour; and lastly, the swelling cannot be reduced by pressure applied to the artery above, or by compressing the aneurism. In aneurism of an artery of the second or third magnitude, through which the current of blood flows less forcibly, coagulation advances from the sac into the *vessel*, which gradually becomes plugged up, above and below, with a coagulum, extending to the next important branch above and below the aneurism. This advance of coagulation is accompanied with the cessation of pulsation. Eventually the aneurism contracts and dwindles into a comparatively small solid swelling; while the artery, to some extent, above and below it, is converted into an impervious fibrous cord. During this process of obliteration, compensation has been gradually made for the loss of the original supply of blood through the artery. The collateral branches above the unobliterated portion of artery enlarge with the additional flow of blood through them, and becoming equal to their extra duty, at length convey as much, or even more, blood than the aneurismal artery formerly supplied. The circulation is adequately restored, and nutrition efficiently sustained, by this compensatory supply of blood.

Remembering the internal cause of aneurism, as already explained, and also the physiological fact that the coagulation of blood is favoured by *rest*, we at once perceive how anything which *retards* the flow of blood through an aneurismal sac tends to restore its resisting strength, and is therefore proportionately conducive to the cure of aneurism. The same effect is produced by anything which *otherwise* favours coagulation of the blood within the sac.

Firstly. The flow of blood may be retarded by a less forcible propulsive power of the heart; in which case coagulation is possibly induced without any co-operative condition incidental to the aneurism itself. The sac is gradually filled up to its brim; then, possibly, the artery is plugged, and finally obliterated. This is the usual mode of spontaneous cure.



Secondly. The flow of blood through an aneurismal sac may be retarded by a piece of clot dislodged from the sac, and washed into the mouth of the distal portion of artery, or impacted within it some distance off.

Thirdly. A piece of clot may be floated down to the aneurism from one higher up, or the retarded flow of blood above may induce coagulation in the lower sac.

Fourthly. The flow of blood may be retarded by the aneurism overlapping and compressing the portion of artery immediately above or below itself.

Fifthly. Coagulation of the blood within an aneurismal sac may be induced otherwise than by any occasion of a retarded flow of blood. Adhesive inflammation possibly, and certainly sloughing, obliterates the sac, and leaves the artery impervious.

Several remarkable instances of spontaneous cure by closure of the sac *alone* are recorded in Mr. Hodgson's work.\* Not only aneurisms of the aorta (p. 119 *et seq.*), but also those of smaller arteries—*e.g.* the brachial and anterior cerebral (p. 130 *et seq.*), were thus effectually closed, without any obliteration of the aneurismal artery. For similar instances, where the aneurisms were due to unskillful blood-letting, the reader is referred to the works of Scarpa,† Petit,‡ Foubert,§ and Saviard.||

In an aneurismal dilatation of the *whole circumference* of an artery—*Fusiform or Tubular Aneurism*—the cure by coagulation is just possible, only modified in a remarkable manner to meet the exigencies of the case. In one case, recorded by Sir A. Cooper, the femoral artery, from its origin to the extent of more than three inches, was dilated into a sac, which was lined throughout with very firm layers of coagulum, having a fleshy appearance. But this deposition did not completely obstruct the passage through the sac; for an irregular canal, in some places larger than the natural bore of the artery, still remained through its centre. The coagulum that formed the immediate boundary of this canal was more condensed than any other portion of the whole, and had a membranous appearance. Here, then, while coagulation had effectually *strengthened* this important artery, its *continuity* was preserved by an adequate channel through the coagulum. Only so much, and no more, coagulum had formed as was absolutely necessary to accomplish this twofold purpose.

Aneurism sometimes terminates safely in another way; but, not implying the favourable course and tendency of this disease, it must be regarded rather as an accidental mode of recovery, by an *evil* occurrence, than as a mode of natural cure, although no assistance is given by art. I allude to the bursting of an aneurism under a tight fascia, or other resisting structure; and compression of the sac and artery, even to obliteration, by the extravasated blood. One example of this kind is related by Sir A. Cooper. An aneurism of the femoral artery, just below Poupart's ligament, having burst, the thigh became enormously swollen. For three days afterwards, pulsation was perceptible over the aneurism. Then, however, it ceased, and the size of the limb began to diminish. At the end of four months, the aneurismal swelling had considerably subsided; the patient could use his limb, and in less than six months he quitted the hospital. Subsequently he died from the rupture

\* Diseases of Arteries and Veins, and on Aneurism, 1815.

† Treatise on Aneurism, trans. Wishart, p. 351.

‡ Mém. de l'Acad. Roy. des Sciences de Paris, an. 1735.

§ Mém. de l'Acad. Roy. de Chirurgie, t. ii. p. 535. || Journ. des Sçavans, an. 1691.

of an abdominal aneurism, and *post-mortem* examination showed that the femoral artery was obliterated by the pressure of the large quantity of blood effused.

Another mode of accidental recovery through a circumstance itself morbid, is by the pressure of an aneurism of a neighbouring artery, or by that of a tumour not aneurismal. Liston mentions the instance of a subclavian aneurism, which on dissection was found solidified by the compression of another aneurism springing from the innominate artery.

(2) *Diffused Aneurism*, when it remains in this condition, runs the course already indicated by its operation as an internal cause of local and constitutional disturbances. The tumour progressively enlarging even to an enormous size; and ultimately bursting, externally, internally, or in both directions; the career of such aneurism tends inevitably to further and fatal hæmorrhage.

*Duration of Aneurism.*—This would seem to be regulated chiefly; by the force of the circulation, the proximity of the aneurism to the heart, the size of the neck of the sac, and its direction relatively to the current of blood, and by the coagulating power of the blood. Rest, and the mode of treatment, will further affect the duration of aneurism. But the course of all aneurisms is generally slow; extending to a few months, a year, or possibly several years. The slow dilatation of aneurism was established by a series of cases which John Bell collated with his usual care; and in one extreme case of femoral aneurism recorded by Hodgson, the period of its duration was twenty years.

*PROGNOSIS.*—The prognosis of Aneurism should be determined mainly, by a due consideration of the persistency, or otherwise, of its causes. [P. p. 716]. Degeneration of structure affecting the coats of an artery, implies the loss of that adequate resistance and resiliency to the current of blood, which having given rise to Aneurism will also perpetuate it. The extent to which degeneration usually affects the arterial system, more than one artery being the seat of this destructive change, is an additionally unfavourable consideration. Hence, a *single idiopathic* aneurism always suggests a suspicious prognosis. *Traumatic Aneurism* suggests an unfavourable prognosis, only in proportion as the aneurismal swelling is progressive. The conditions which mainly regulate the *duration* of aneurism are obviously important, as persistent causes in regulating its dilatation and progress. In so far as these conditions are discoverable during life, their consideration will complete the prognosis.

*TREATMENT.*—Remedial measures—hygienic, medicinal, and operative—should be entirely responsive to the natural or spontaneous cure of aneurism. The ordinary mode in which natural cure takes place, is, by retardation of the current of blood through the aneurismal artery, sufficiently to induce coagulation and the deposition of laminated fibrine within the sac.

i. As conducive to this end, the primary indication of treatment is *rest*, prolonged rest, of mind and body. *Position* is an important adjunct, by taking off the force of the arterial current. The recumbent position will be most suitable for aneurism in any part of the body. *Gradual starvation* and *depletion*, to diminish the quantity of blood in circulation, and to reduce the force of the heart's action, have some remedial influence; but only within judicious limitations. Farinaceous, rather than animal food, a sparing proportion of liquids, and total abstinence if possible, from stimulants; constitute the chief features of the diet to be

observed. That which was recommended by Bellingham, answers to this description. It consisted of two ounces of bread-and-butter for breakfast, two ounces of bread and the same quantity of meat for dinner, and two ounces of bread for supper, with a little milk and water, occasionally, sipped in small quantities. Depletion, by watery purgatives, is preferable to blood-letting; and should the latter be resorted to, it is, in Sir Thomas Watson's judgment, remedial only so far as it reduces any excessive force of the circulation. The small and repeated bleedings practised by Valsalva, may be advantageous, in some cases; but certainly not when pushed to the extreme he advocated; syncope, when the patient attempted to stand, or even on rising in bed. Respecting *medicinal* measures for controlling the heart's action, I have no authentic information to offer. The therapeutical results of medicines having reputed efficacy in relation to aneurism, are vague and unsatisfactory.

Having succeeded in lessening the *force* of the circulation, sufficiently to diminish the expansive pulsation of the aneurism; are there any known means of *directly* favouring the *coagulation* of blood, and the deposition of laminated fibrine, within the sac? By increasing the quantity of fibrine in the blood and its tendency to coagulate, in short, by improving the plasticity of the blood itself, this indication may be fulfilled. Animal food, therefore, should now be substituted for farinaceous, and in larger quantity: but the same restriction, or nearly so, should be observed with regard to liquids, and particularly stimulants. This combination of treatment, for lessening the force of the general circulation, and then supplying the fibrinous material for coagulation; constitute the régime originally proposed by Valsalva. Pathologically correct in itself, it was wrong only in the extreme degree to which he carried it practically.

Certain *local* applications externally are said to aid the coagulation of blood within the sac, but their efficacy is doubtful. Ice enjoys the repute of being thus beneficial; its constant or repeated application, is, however, apt to endanger sloughing of the integuments. Its occasional use may relieve pain. But, for this purpose, the belladonna plaster, or an embrocation composed of equal parts of oil and of the strong tincture of aconite; form topical appliances which, according to Mr. Erichsen's experience, afford much relief.

ii. *Mechanical, and Operative, resources*; obediently to the *first* mode of natural cure.

In the event of an endeavour to reduce the force of the *general* circulation, and thus to favour coagulation in the sac, having proved unsuccessful; recourse must be had, without further delay, to such local measures as may retard the force of the arterial current through the *aneurismal artery*, exclusively. Mechanical appliances for this purpose, favourably contrast with any cutting operation. The former mode of treatment anticipates the necessity for obliterating the aneurismal artery, and avoids also the danger consequent on any operative procedure for securing the vessel.

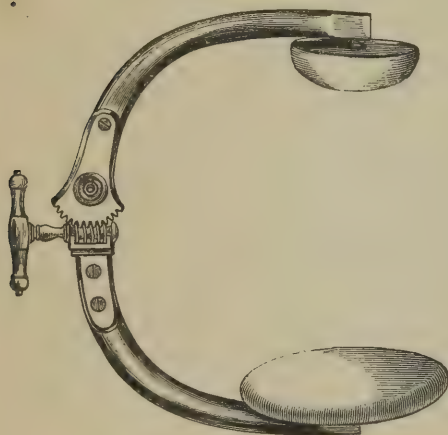
(1) *Compression* of the artery *above* the aneurism. This plan of mechanical treatment should be guided by two principles. It is unnecessary to entirely arrest the stream of blood through the artery above the aneurism, and therefore unnecessary to obliterate the vessel by inflammation, in order to effect a cure. It is only requisite to lessen the *force* of the stream, and *temporarily*; thus to give a fair start to the deposition of laminated fibrine, and so at length regain the balance of resistance naturally offered by the artery to the pulse-wave of blood passing through it. A



degree of compression just sufficient for this purpose, and applied intermittently for a few hours daily, will represent the kind and amount of assistance necessary; instead of complete occlusion and by continuous pressure, which might lead to obliteration of the artery. This, the old method of compression, as employed by Dubois and Pelletan, has been judiciously superseded by the more conservative modification introduced by the Dublin school, and with which the names of Bellingham, Hutton, Tufnell, and Carte, are principally associated. Compression is the means employed, in either case; but the old method was simply blind empiricism, the modern one, is a strict imitation of the mode of natural cure.

*Instrumental Compression.*—Various forms of Instruments have been devised for compressing an artery, above the seat of aneurism. The *compressor* used may be in the shape of the horse-shoe or Signoroni's tourniquet (Fig. 57); or that invented by Carte, the advantage of which is, that it provides an elastic and yielding pressure, instead of the unyielding force of the screw.

FIG. 57.



Before applying this or any compressor, the limb should be evenly bandaged, to prevent congestion of the vessels, as much as possible; and the irritation occasioned by the pad of the instrument, may be much prevented, by shaving and powdering the integuments of the part. The degree of compressing force appropriate should be estimated by its effect in controlling the pulsations in the aneurism; it being only necessary to suspend them, without entirely arresting the transmission of blood. The total duration of intermit-

tent compression requisite, may be estimated by its effect in promoting coagulation and consolidation of the tumour; the period necessary for this purpose varying considerably, from a few days to some months. Thus, in 26 successful cases,\* this period ranged between sixty hours and eight months; its average duration being nineteen days.

No medicinal treatment is indispensable to the completion of the process of cure, when thus aided by compression. If, notwithstanding the precaution of shaving and powdering the part, pain be occasioned by the pad in such degree as to disturb sleep, then indeed opiates may be administered; but, in most cases, this inconvenience will be anticipated by proper management of the instrument. It is well to try it on, so to speak, gently at first, and augment the pressure by little instalments; also to shift the pad from place to place in the course of the artery; and, as Tufnell suggested, to lighten it slightly, so that when the patient has fallen asleep, the pressure may be renewed without awakening him. This plan of treatment being a faithful imitation of the process of natural

\* Medical Times and Gazette. Statistical Results, by J. Hutchinson.

cure by retardation of the passage of blood through the aneurism ; it is not surprising to find that the anatomical condition induced is the same as that resulting from the unaided process. In both cases, the aneurism is solidified and partly absorbed, leaving the artery pervious ; while collateral branches proceeding from the parent trunk, are enlarged ; thereby contributing to maintain the circulation and nourishment of the limb below the seat of aneurism. Thus, during compression of the femoral artery, for popliteal aneurism, three arteries are observed to undergo enlargement ; one passing over the centre of the tumour, another externally, over the head of the fibula, and a third internally, along the inner margin of the patella. This observation, originally due to Tufnell, is corroborated by Mr. Erichsen.

The *statistical* results which appear most worthy of credit, with respect to compression as practised in England, are those collated by Mr. Hutchinson from the Metropolitan and Provincial Hospitals. Of 70 cases, 46 were popliteal aneurism, and in 24 of them, this treatment was successful. The remaining 22 cases had reference to the treatment by ligature of the femoral artery, as compared with compression. The experience of the Dublin Schools is far more favourable. Of 25 cases collated by Bellingham,\* in 1 only was the ligature subsequently resorted to.

The only disqualification of instrumental compression for the treatment of aneurism, is its *impracticability* in certain parts of the body. It is almost necessarily restricted to the treatment of femoral and popliteal aneurisms.

*Direct* compression of the aneurism was formerly practised, with the view of opposing the *expansive* force of the current of blood and consequent enlargement of the sac. But pressure thus applied, not being designed to check the force of the current *through* the aneurismal portion of artery, was an unpathological mode of treatment ; and moreover, it was apt to cause inflammation and sloughing of the sac. This modification, therefore, which was first employed by Bourdelot, and adopted by Guittani, Heister, and other Surgeons, not unsuccessfully, at length gave way to compression on the cardiac side of the artery.

*Digital* compression, or pressure with the fingers, may be conveniently applied to aneurisms, in situations ineligible for instrumental compression. They are chiefly those of the axillary, subclavian, and carotid arteries. In these situations, pressure with the fingers on the cardiac portion of the aneurismal artery, will aid the natural process of cure by retarding the flow of blood through the sac. The requisite continuance of compression is provided for, by having a sufficient number of assistants ; each, in turn, taking charge of the vessel before the previous one withdraws his finger, and observing to apply only that degree of pressure which controls the pulsations in the aneurism. Having maintained compression, in this way, for a few hours, the patient may be advantageously allowed a period of intermission, followed by its reapplication, and so on alternately. The total duration of these periods necessary to complete the cure, varies of course in different cases. In 19 cases successfully treated by digital pressure, the average number of hours was not more than forty-one and a half ; spread, however, over a variable period of time, owing to intermissions of the pressure. Whereas, according to the most favourable reports of those who are greatly interested in the treatment by instru-

\* Observations on Aneurism, and its Treatment by Compression, 1847.

mental compression, the average duration of treatment by that method, was twenty and a quarter days in each case.\*

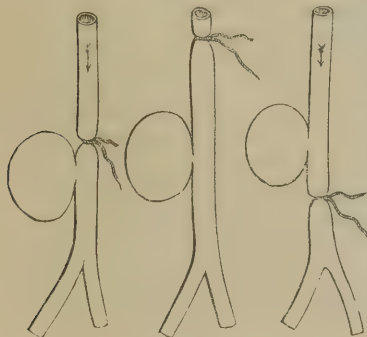
Digital compression, for the cure of aneurism, is of quite recent date as compared with instrumental compression. In 1846, Professor Vanzetti first attempted it for the cure of a popliteal aneurism, at the Hospital of Karkof, in Russia. The case was deemed unsuccessful after only two days' treatment, and forthwith a ligature was resorted to. The particulars were not published until 1858.† Meanwhile, in 1848, Dr. Knight,‡ of Newhaven, United States, for the first time, successfully employed digital compression, as the sole means of cure; in a case of popliteal aneurism, and which had resisted compression by every kind of instrument. At the end of 48 hours' pressure, thus applied to the femoral artery, the tumour in the ham had become one-third smaller, hard, and pulseless. The treatment was then discontinued, and four months subsequently, the tumour could scarcely be felt. Encouraged by this and similar cases, digital compression has since been on its trial, and this method now bids fair to rival instrumental compression. It is more simple, comparatively painless, a more speedy cure, equally effectual, and as permanently so.

Compression by *flexion*, is another, and even yet more simple method of pressure; but limited in its applicability to aneurism situated in the flexure of a joint. Thus, the cure of popliteal aneurism may be effected, simply by flexing the leg on the thigh and securing it in that position by a bandage, previously rolled round the limb from the toes upwards to prevent congestion. The degree of flexion requisite is an acute angle in the first instance; or better, a right angle only, at first, and gradually diminished. The duration of genuflexion necessary can scarcely yet be averaged. In the first successful case on record, that by Mr. Ernest Hart,§ the cure was considerably advanced after the first day, and complete on the fourth; on the seventh day the patient was moving about. In a case by Mr. Shaw,|| the cure was far more protracted, the cessation of pulsation not having been observed until the 30th day; but in this instance, the tumour was of larger size. Many cases also are reported in

which flexion has been successfully used in combination with pressure. One, by Mr. Pemberton,¶ another by Mr. A. Pritchard.\*\*

(2) *Ligature*.—(a) Ligature of the aneurismal artery on the *cardiac* side, and at *some distance* from the sac—in a *sound* portion of artery. This is the Hunterian operation for Aneurism. (Fig. 58, middle figure.) The application of a ligature to any part of an aneurismal artery, divides the vessel when the ligature separates; thus permanently intercepting the transmission of blood through the artery, itself perhaps a main trunk.

FIG. 58.



\* System of Surgery, edited by T. Holmes, vol. iii., Aneurism.

† Annali Universali di Medicina, 1858.

‡ Trans. of the Amer. Med. Assoc., 1848, p. 169.

§ Med.-Chir. Trans., vol. xlii. p. 205. || Ibid., vol. xlii.

¶ Lancet, 1859, vol. ii. p. 232.

\*\* Brit. Med. Journ., 1861, March 30th.



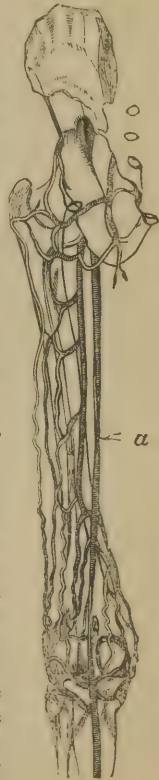
This treatment, therefore, should be an ulterior resource to temporary compression, in any form; obliteration of the vessel not becoming necessary until after temporary compression—preceded by hygienic (and medicinal) measures, for retarding the general circulation—has failed.

Ligature on the cardiac side of an aneurismal artery, as a surgical procedure, is another illustration of treatment in accordance with the mode of natural cure by retardation of the current through the aneurismal artery; but it is a further concession of such assistance, and proportionately less conservative. I have, therefore, postponed the consideration—as in practice, the application—of compression by ligature; until after that of other handy modes, without any surgical operation, have been tried and found wanting. Then; if the heart be competent to withstand the obstruction to the circulation consequent on the operation, and no internal aneurism complicate the case;—under these *favourable* circumstances, obliteration of the aneurismal artery, by ligature, is a justifiable resource.

There are, however, certain *unfavourable*, if not positively contra-indicating, circumstances, with respect to this extreme measure. Ossification of the artery at the seat of ligature, would be a decidedly adverse condition. But this can scarcely be discovered prior to operation. A rapidly enlarging aneurism is unfavourable, as evincing an indisposition to the deposition of laminated fibrine. Then again, a very large aneurism is unpropitious, as threatening gangrene of the limb; an event almost inevitable, if the circulation were suddenly cut off by ligaturing the artery. Inflammation of the sac will be an unfavourable condition, by possibly proceeding to suppuration; and suppuration itself would be a positively forbidding condition, by rendering the result of ligature abortive.

The Hunterian operation, first performed in December 1785, consists in applying a ligature, on the cardiac side of the aneurism, to a *sound* portion of the artery; and therefore at some distance above the aneurism. For popliteal aneurism, the superficial femoral artery is ligatured, where this vessel is crossed by the sartorius muscle, in the middle third of the thigh. The force of the current of blood having been thus reduced, coagulation within the sac is promoted, yet without cutting off the supply of blood entirely. A sufficient quantity is transmitted for the process of coagulation, by collateral branches issuing from the artery above the ligature and communicating with the vessel below, but above the aneurismal sac; while there is also a sufficient quantity of blood transmitted onwards, and also by collateral branches which become adequately enlarged, for the maintenance of the limb below. (Fig. 59.) Meanwhile, coagulation and the deposition of laminated fibrine is proceeding in the aneurismal sac, and it extends into the artery as high, perhaps, as the ligature; both the sac and this portion of the artery thus become consolidated; the ligature separates, in the usual manner, by sloughing of the ring of artery within the noose, and the divided

FIG. 59.



ends of the vessel are simultaneously sealed with plastic lymph. This takes place in a period ranging from ten days to a month; but varying chiefly according to the size of the artery, and the plastic power of the individual. Of fifty-four cases recorded by Crisp, in which the femoral artery was ligatured, the average period for the separation of the ligature was eighteen days. Finally, the consolidated aneurism and artery undergo partial absorption; so that the latter withers and degenerates into a fibrous cord. The limb, nourished by the collateral circulation, may nevertheless become somewhat atrophied.

(b) Anel's operation, 1710, contrasts with the Hunterian, in its ultimate *purpose*, more than as an operative procedure.

The operation proposed by Anel, was to ligature the aneurismal artery, on the cardiac side, but *close* to the aneurism. (See Fig. 58, left figure.) The aneurismal blood escaping through the distal portion of artery, the sac would, it was thought, collapse, and thus the tumour disappear. For this purpose, the blood must remain fluid in the aneurism, instead of undergoing coagulation and the deposition of laminated fibrine, with occlusion of the sac, followed by the absorption of both, the tumour disappearing in that way. Although, then, these two operations are somewhat similar, they differ widely in their ultimate purpose as to their modes of cure. Moreover, Anel, having performed his operation once only, and for *traumatic* aneurism of the brachial artery at the head of the elbow, he never himself repeated it, nor advocated its repetition, in similar cases. He apparently regarded his operation as applicable only in that particular case; unlike Hunter, as a *conception* ruling the treatment of a large class of cases.

It is with reference to *idiopathic* aneurism—as implying a diseased state of the artery—that the operations of Anel and Hunter notably contrast; and when compared with the only operation which had previously been designed for the cure of such aneurism.

The *old* operation, or that of Antyllus, consisted in extirpating the aneurism. An incision was made throughout the whole extent of the aneurismal sac, in order to scoop out the coagulum and expose the two orifices of the artery leading into the sac; immediately above and below those points a ligature was passed round the vessel, securing it in both directions. But an *unsound* portion of artery was thus selected—that immediately above and below the sac, which participated in the degenerative change of structure that originally gave rise to the aneurism. Hence, secondary hæmorrhage, perilous or perhaps fatal, generally occurred when either ligature separated, and as often necessitated amputation; while invariably, the large wound of the aneurismal operation healed tediously and often precariously to life by exhausting suppurative discharge. In Hunter's operation, a *sound* portion of artery was selected, thus avoiding these evil consequences. This operation, therefore, at once superseded that of Antyllus, and Anel's also—the ligature having been applied equally close to the aneurism in that operation. But the principle of Hunter's operation—in relation to the *natural cure* of aneurism, differed even more essentially from both these operations; in the assumption that it was necessary only to reduce the force of the circulation by applying the ligature at some distance from the aneurism, for the process of natural cure to supervene, instead of entirely arresting the current of blood through the aneurism by ligaturing the adjoining portion of artery.

*Signs after Ligature, by Hunter's Operation.*—Certain alterations in the

signs of aneurism, attend or follow the Hunterian operation of ligature. The aneurism ceases to pulsate and partially subsides. These changes taking place immediately the ligature is drawn tight, are valuable signs of its successful application. The circulation of blood being proportionately arrested in the limb, it becomes numb and cold, and its muscular power is diminished. As the collateral circulation is established, these immediate effects disappear, and the temperature of the limb may rise above that of its fellow.

*After-treatment.*—The treatment *after* this operation should be directed to avert the temporary tendency to gangrene, pending the establishment of an adequate collateral circulation. Hence, the circulation and temperature of the limb must be maintained. A thick wrapper of carded wool answers most effectually, aided by a suitable elevation of the limb to relieve congestion. A moderately nourishing diet with stimulants, and the judicious administration of opium, will tend to sustain the process of cure.

*Consequences.*—Certain *unfavourable consequences* and *evil results* may ensue from this application of the ligature for aneurism.

1. *Pulsation may continue or return* in the aneurismal sac. The small stream of blood conveyed by collateral branches into the artery below the ligature, and thence into the sac, depositing the laminated fibrine, is not a pulsatory current. If, however, these feeding vessels are larger than sufficient for this purpose, pulsation continues, or soon returns; if they enlarge immoderately, then also pulsation returns. Any regurgitation of blood into the sac, from below, and therefore in opposition to the current, need scarcely be taken into account. If it occur, it will cause gradual enlargement of the aneurism, without pulsation; simulating the gradual increase of a malignant tumour. Rarer causes are these—Any condition of the blood, which, delaying or hindering coagulation, disposes it to remain fluid in the sac, will favour the continuance of pulsation. A vas aberrans may exist, which communicating directly, or indirectly, with the aneurism, thus continues its pulsation. An instance of this kind occurred to Sir Charles Bell.\* He ligatured the femoral artery for popliteal aneurism. The patient died a week afterwards from erysipelas; and it was then discovered that the femoral artery was double, and that the vas aberrans had continued to supply blood to the aneurism in the ham, after the operation. Yet in this case, the sac had become completely consolidated with coagulum, and in the short period of one week. The preparation is in the museum of University College, London. Other contingencies—by which the pulsation of an aneurism continues after the application of a ligature—relate to the operation. The ligature may not have been applied to the aneurismal artery; or having been applied thereto, the noose may have been tied obliquely, instead of transversely, then shifting its place and loosening its hold, the pulsation continues, or returns, soon after the operation.

Of all these causes of pulsation after the Hunterian Operation for aneurism, that arising from an undue collateral circulation, as explained, is by far the most common. But it occurs with different degrees of frequency in different arteries. In carotid aneurisms it is most frequent. Of 31 cases, in which the carotid artery was ligatured for aneurism, pulsation continued or returned in 9; whereas of 92 cases of inguinal aneurism, in which the external iliac artery was ligatured, pulsation

\* London Medical and Physical Journ., vol. lvi. p. 134.



returned in 6 cases only. In axillary and popliteal aneurisms, respectively, recurrence of pulsation is an exceptional event.

It should be remembered that a slight thrill may very frequently be felt in an aneurism, on the second or third day, after the application of a ligature by the Hunterian method. This, however, is a favourable occurrence, as it bespeaks a feeding stream of blood for coagulation in the sac; and it supervenes with about equal frequency in all aneurisms, irrespective of any particular portions of the arterial system, and the distribution of vessels accordingly. The thrill, thus arising, soon subsides—with consolidation of the sac. Returning pulsation, on the other hand, if it occurs, usually begins at a much later period, not until a month or six weeks have elapsed, and continues for some time.

Returning pulsation is seldom persistent, and rarely terminates fatally. Of 26 cases in which pulsation returned, 3 only were fatal, and then not owing to this event, but by sloughing of the sac.

2. *Secondary Aneurism*, or aneurism reappearing by *redilatation* of an aneurismal sac, which had previously undergone consolidation and absorption, is an extremely rare event. This must not be confounded with returning pulsation. Mr. Erichsen believes there are only two unequivocal instances on record, both of which were in the ham; the original tumour having disappeared entirely, this secondary disease made its appearance, after the lapse of six months, in one case; and after four years, in the other instance. Secondary Aneurism, in the sense of another *distinct* aneurism arising close to the former one, double aneurism, in fact, is quite another matter.

*Treatment of Pulsation; continuous or returning.*—This, of course, must have reference to the cause or causes of the pulsation. Arising, in most instances, from an undue collateral circulation communicating, directly or indirectly, with the sac; the pulsation will cease as the deposition of laminated fibrine proceeds therein. The process of natural cure rights itself. Failing this result; the balance between the deposition of fibrine and the supply of blood, may be slowly gained, or regained by sufficiently elevating the limb; while the pulsation can be directly restrained by moderate pressure on the aneurism, with a compress and roller, evenly applied. These resources not proving effectual, the coagulating power of the blood deserves consideration; but our knowledge respecting its operation within the body is at present very limited. Here then pathology fails to guide the treatment. The presence of a *vas aberrans* is discovered at the time of operation, by ascertaining whether the ligature *entirely* controls the pulsation of the aneurism. If not, the tributary vessel should be sought. It will not be far off, and it must be secured by another ligature. In like manner, the aneurismal artery is *identified*, by trying the pulsations of the sac, when the supposed aneurismal vessel is commanded above; but this should be done *before* the ligature is applied. Lastly, application of the ligature *transversely* round the artery, will avoid any chance of pulsation continuing or returning, as occasioned by shifting of the noose.

Extreme cases, which baffle all these resources and precautions, necessitate further operative proceedings. *Reapplication* of the ligature may have to be resorted to; either lower down the artery—nearer the sac, as an approach to Anel's operation—or, by opening the sac, turning out the clots, and tying the artery immediately above and below—the old operation of Antyllus. I know of no *data* for determining the Surgeon's

choice, but the latter operation, whereby Nature's work of coagulation and consolidation is undone, should be resorted to reluctantly. *Amputation* is the very last resource.

3. *Gangrene of the limb* proceeds from causes of an opposite character to those which induce pulsation in the aneurism, after the Hunterian operation. The latter are conditions which favour an undue collateral circulation through the sac; the conditions to which I now allude retard any collateral circulation. *Firstly*; an aneurism itself retards the current of blood through the artery, and operates also by compressing the neighbouring vessels; thus preventing the transmission of arterial blood, and the return of venous blood. Gangrene threatens. The application of a ligature to the aneurismal artery is an additional obstruction, rendering the condition more perilous; and if the collateral circulation be interrupted by the large size of the aneurism compressing the neighbouring vessels, then gangrene ensues. *Secondly*; surgical mismanagement of the limb, after operation, by inattention to position and temperature, or the presence of any morbid condition which lowers the vitality of the limb, will severally tend to induce gangrene.

It supervenes in a period, varying from the third to the tenth day; but in rare cases, not until the third week. (Porter.)

*Treatment*.—So far as gangrene is due to the ligature, it cannot be prevented; but if due principally to interruption of the collateral circulation by pressure of the sac, this source of obstruction can be removed by the old operation of cutting down upon the sac, laying it freely open, and turning out the clot. At least two such successful cases, both of popliteal aneurism, are on record; one by Lawrence,\* another by Benza. Other preventive measures, topical, dietetic, and medicinal, have already been noticed in reference to the appropriate treatment after ligature. With gangrene, as with recurring pulsation, amputation of the limb is our last resource; and the operation must be performed above the situation of the ligature.

4. *Suppuration and sloughing of the sac*, is attended with the usual symptoms of inflammation—heat, pain, and throbbing. At length the integuments give way, and portions of clot escape, having various degrees of consistence and shades of blood-red colour. Then hæmorrhage of fluid arterial blood occurs, either with a fatal gush, or recurring in small but increasing quantities. Which form of hæmorrhage shall take place is apparently determined by the degree to which consolidation of the aneurism has advanced; and, therefore, in a measure, by the time of its occurrence after ligature. The amount of hæmorrhage is regulated in like manner, it being most free and uninterrupted in the event of pulsation continuing or returning.

The *causes* of suppuration and sloughing of the sac, and of hæmorrhage thence arising, in the course of aneurism, are any conditions unfavourable to the vitality of the sac. Hence, the large and increasing size of an aneurism, and the imperfect coagulating power of the blood therein, have this tendency. So also any external injury to, or irritation of, the sac. Considering these and other similar accidental circumstances, the period after ligature when suppuration may supervene, is, obviously, very uncertain. It may happen at any time in the subsequent course of the aneurism. The average time is, perhaps, between the third and eighth

\* Medical and Physical Journ., vol. lv.

weeks, but in a case of carotid aneurism recorded by Sir A. Cooper, suppuration occurred at the eighth month after operation. Comparatively few cases terminate fatally; probably not more than one in four, and then, generally, by hæmorrhage.

*Treatment.*—This will be guided by the stage and result of suppuration. In the first instance, the sac should be treated as an ordinary abscess; only that when an incision is made, it should be free enough to turn out the whole of the clot. Any remaining portion is likely to putrify and become a fœtid, purulent discharge; but when removed entirely, the sac is in a condition to heal from the bottom by granulation. *Hæmorrhage*, of course, is imminent. A tourniquet, therefore, loosely applied to the limb above, will be a judicious precaution which can be brought into use at any moment. In the event of hæmorrhage; loss of blood may be temporarily stayed by a compress of sponge well placed at the bottom of the sac, over its mouth; and of sufficient size to be secured in position by a roller, evenly applied. Then comes the question of how to permanently arrest the hæmorrhage? The diseased state of the artery immediately above and below the sac, in idiopathic aneurism, forbids the application of a double ligature *in situ*, as by the old operation. Ligature of the artery higher up than was performed prior to suppuration, would probably be the turning point for the commencement of gangrene. In this dilemma, the Surgeon may advantageously wait and see what Nature can accomplish, as the healing process of granulation closes over the arterial aperture in the sac; guarded always by the compress, and during its reapplication occasionally, by tightening the tourniquet.

This faithful following up of Nature's operation having failed, our only resource is amputation.

5. *Secondary hæmorrhage* from the operation-wound, after ligature by the Hunterian method, is an event unconnected with the course of Aneurism. It is a failure of the operation; and, as it arises from sloughing of the included portion of artery before the preparatory closure of either or both ends of the vessel has taken place, the hæmorrhage occurs whenever the ligature separates. The average time was the 18th day, in 54 cases, recorded by Dr. Crisp, of ligature applied to the femoral artery. It is more likely to occur, the nearer the artery is to the heart, the central force of the circulation.

The *treatment* in this case is not presumed to be restricted by any diseased state of the artery, at the seat of ligature. Consequently, the re-application of *two* ligatures, one to each end of the artery at the point of division, will most probably prove effectual; the former operation-wound having been just sufficiently reopened for this purpose. Temporarily, the hæmorrhage may be arrested or checked, by plugging with sponge or lint.

*Statistical Results.*—Ligature for Aneurism shows a considerable mortality. In 256 cases of this operation on the larger arteries, the deaths were about 22 per cent. This was shown by Dr. Crisp's tables. The result of investigations by Porta is even more startling. In 600 cases of ligature for diseases and injuries indiscriminately, the mortality rose to 27 per cent. Then again, as compared with *compression*, the balance is decidedly in favour of the latter mode of treatment. Thus, according to Norris; of 188 cases of ligature for femoral and popliteal aneurisms, 142 were cured, 46 died, 6 limbs were amputated; in 10 suppuration of the sac supervened, and in 2 gangrene of the foot; giving



a total, of deaths, about 1 to 4, and failures 1 to 3. Whereas, of 32 compression cases, also of femoral and popliteal aneurisms, collected by Bellingham; 26 were cured, in 1 ligature was resorted to after compression had failed, in 2 amputation became necessary, in 1 death occurred from erysipelas, in 1 from chest-disease, and in 1 instance, the pressure was discontinued. The failures of compression were, therefore, only as 1 to 5.3; and the deaths only as 1 to 16. Even where compression itself fails, it most advantageously prepares the way for success by ligature. Thus, according to Mr. Hutchinson's Report, in 22 cases of ligature of the femoral artery, previously treated by compression, 2 only died of gangrene; whereas, in only 10 such cases, without preparatory compression, 3 deaths occurred from this cause.

iii. *Manipulative*, and *Operative* resources, obediently, or corresponding, to the *second* mode of natural cure—*i.e.*, retardation of the passage of blood, through the aneurism, by obstruction of the *distal* portion of artery; a piece of clot being dislodged from the sac and washed into the mouth of the distal portion, or becoming impacted within it, some distance off.

(1) *Manipulation*.—This plan of treatment was introduced by Sir W. Fergusson. It consists in so thumbing the aneurism as to dislodge a piece of clot into the distal portion of artery. The manipulative procedure designed for this purpose, is thus described.\* “The patient was seated in a chair, and I placed the flat end of my thumb on the aneurismal tumour so as to cover the prominence. I then pressed, until all the fluid blood had passed from the sac, and I could feel that the upper side of the aneurism was pressed against the lower. I now gave a rubbing motion to the thumb, and felt a friction of surfaces within the flattened mass. The movements were little more than momentary, but they were such as I had preconceived.” Two cases of subclavian aneurism were subjected to this treatment; neither was unequivocally successful, and both were attended with very alarming symptoms at the time of manipulation. In the first case, the aneurism never ceased to pulsate, and after eight months, terminated fatally by rupture of the lower and back part of the sac. The axillary artery was found to be firmly plugged with fibrine. In the second case also, the aneurism continued, but the pulse ceased at the wrist. At the end of two years, and after hard work as a sailor, the aneurism itself had disappeared. In both cases, giddiness and faintness were immediately produced by the manipulation; and in the second case, these symptoms were succeeded by hemiplegic paralysis of the left side, from which, however, the patient recovered in two months.

So far the results of treatment by manipulation were not very encouraging. More disastrous cases occurred in the hands of Esmarch† and Teale of Leeds.‡ Both were carotid aneurisms. On the other hand, an aneurism of the right subclavian artery, thus treated by Mr. R. Little,§ proved quite successful, although not without the disadvantage of temporary paralysis of the arm. Two successful cases in aneurism of the lower extremity; one of the femoral artery, treated by Dr. G. E. Blackman, of Cincinnati,|| and the other of the popliteal artery, by Mr. Teale,¶

\* Med.-Chir. Trans., vol. xl. p. 1.

† Archiv für Path. Anat. und Physiologie, 1857, vol. xi. p. 410.

‡ Med. Times and Gazette, 1859, vol. i. p. 265.

§ Ibid., 1857, vol. i.

|| Western Lancet, June, 1859; also Journ. of Medical Science, New York, 1857, p. 291.

¶ Op. cit.

are, I believe the only additional results, at present, in favour of this method of treatment.

(2) *Compression*, or *Ligature*, of the *distal* portion of an aneurismal artery, represent other methods of imitating the second mode of natural cure; although the obstruction, as thus effected, is not by the impaction of a piece of clot in that portion of the vessel. The operation by ligature of the distal portion, is principally associated with the names of Brasdor and Wardrop (see Fig. 58, right figure). Whether the arterial current be obstructed in this way, or simply, by compression of the artery at that part of its course; in either case, the purpose is, to retard the stream of blood *through* the aneurism, and thence induce the deposition of laminated fibrine with consolidation of the sac.

The immediate effect of distal obstruction, is to turn the full force of the arterial current into the sac; which being distended, may at once yield and burst with fatal hæmorrhage. Should this issue not occur, the collateral branches of artery from the main trunk above the aneurism, will probably have time to enlarge sufficiently to carry on the circulation for the maintenance of the limb; a small feeding stream of blood passing down also to the sac, which undergoes consolidation and obliteration by the process of natural cure. But this happy issue is very precarious and doubtful. According to the results of 27 cases collected by Mr. Erichsen, 20 terminated fatally soon after the operation, and in the other 7 cases, although the patients survived the effects of ligature, the disease remained uncured.

I pass over the *third* and *fourth* modes of natural cure, as they are modified illustrations of either the first or second mode, respectively (p. 326); the fourth mode also illustrating both the first and second. But the conditions by which the curative process is induced in the third and fourth ways are of very rare occurrence in Nature, and have no imitations by Surgical Art.

iv. Certain *Operative* procedures, of a *physical* or *chemical* character, correspond to, if they do not imitate, the *fifth* mode of natural cure; that by inflammation of the sac, and its consequences. *Galvano-puncture* has been practised for the purpose of inducing coagulation of the blood, *en masse*, within the sac. Two needles connected with the wires of a galvanic battery, are introduced into the sac, in opposite directions, until they touch, and fibrine becomes deposited around one of the poles, or needles. The action of the battery should be continued for about ten minutes, and repeated several times.

Under this galvanic influence, a soft clot may form which partially fills the sac; but acting as a nucleus it may induce the deposition of laminated fibrine, and at length occupy the whole sac. Or, a large but loose clot having formed, in the first instance, it may settle down, and thus the sac become consolidated. Or lastly, the current of electricity excites inflammation of the sac, rather than coagulation of its contents; and this may be followed by coagulation, or by suppuration with sloughing of the sac and its obliteration. These are successful issues. But there are cases, and not a few, of an opposite kind. The clot liquifies, pulsation is re-established, and the disease resumes its course. This relapse, after galvano-puncture, is probably due to the mode of coagulation thereby effected; the mass of blood setting suddenly into a semi-solid state, instead of consolidating by the gradual deposition of laminated fibrine. Then again, in the event of inflammation supervening, sloughing is mostly

accompanied with hæmorrhage which may be fatal to the patient's limb or life. Apart from any adverse issue, the pain occasioned by galvano-puncture, is always hard to bear, in some cases intolerable; and the administration of chloroform would be injudicious.

Galvano-puncture is of comparatively recent date. First introduced by Mr. B. Phillips, in the year 1832, it was subsequently followed up by Liston, Gerard, and Keate;\* but with so little success that it fell into disuse. A few years later, however, this proceeding was practised by Pétrequint† and Burci with more success, and thence its revival as an occasional expedient. It is justifiable only, or chiefly, in cases of internal aneurism, or of aneurism at the root of the neck; in fact, where compression, ligature, or any other method of treatment, has failed, or is impracticable.

The *statistical results*, hitherto recorded are very unfavourable. According to Bonnet, up to July, 1851, 23 cases of aneurism had been subjected to this treatment; 8 were of the brachial artery, 7 of the popliteal, 2 of the subclavian; 1 of each of the following arteries — ophthalmic, temporal, carotid, thoracic-aorta, ulnar; and 1 unknown. Of these, 13 cases were unsuccessful, and although 9 were reported as successful, 7 of them were due rather to compression and the application of ice, or to inflammation and suppuration of the sac, than to galvano-puncture. It failed, therefore, in no less than 20 cases out of 23; leaving only 2 favourable results, excluding the unknown case. Subsequently, out of 50 cases, collected by Ciniselli,‡ 23 were cured, 20 were not cured, and 7 were fatal.

The *injection of coagulating agents*, has been practised, like galvano-puncture, with the view of inducing coagulation *en masse*, within the sac. Various such agents have been tried. The least hazardous, and the most efficacious, appears to be, a weak solution of perchloride of iron, used in small quantity. A solution of 20° Beaumé, is the highest degree of strength recommended by Vallette; and twenty drops only to every 100th of a pint of the blood in the sac, is the quantity permitted by Broca. The safest instrument for injecting is a small glass syringe, graduated, furnished with a screw piston, and a fine-pointed nozzle. (Fig 60.) Before introducing it, the circulation through the artery should be suspended by compressing the vessel carefully on either side of the aneurism. Then the point should be thrust perpendicularly into the aneurism, until a drop or two of arterial blood escaping, shows that it has penetrated. The instrument may be directed to different points within the sac, and a drop or two deposited successively, forming as many centres of coagulation. On withdrawing the instrument, a turn of the piston, backwards, will prevent any of the solution escaping under the integument. This operative procedure is thus completed, easily and speedily.

Taking all these precautions, as to strength and quantity of the

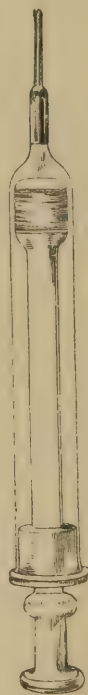


FIG. 60.

\* Lancet, 1837-8, vol. ii. p. 668.

† Compte rendu de l'Acad. des Sciences, 1845, vol. xxi.

‡ Sulla Elettropuntura nella cura degli Aneurismi, 1856.



solution and its injection into the sac alone, coagulation may proceed to consolidation and cure. But the process may stop short of this issue; or inflammation be excited in the sac, which, owing to the highly irritating character of the solution, will probably result in suppuration and sloughing, with fatal hæmorrhage, or by extending to the surrounding integuments, may end in gangrene of the limb. Thus, then, the probable consequences of this treatment restrict its eligibility; while the kind of coagulation induced *en masse*, disqualifies it proportionately, for the cure of aneurism. Then again the requisite compression of the artery on the cardiac and distal side, limits the applicability of injection to aneurisms in certain situations only. Internal aneurisms are excluded; and external aneurisms—those of the extremities—are open to far preferable methods of treatment—compression or ligature.

Injection seems to have been practised indiscriminately, or at least without regard to the situation of the aneurism. Originally suggested by Monteggia,\* injection was tried, with different coagulating agents, by Vilardebo,† Wardrop,‡ Leroy d'Etiolles,§ Pravaz, and Pétrequin.|| Aneurisms in every part of the body have been subjected to this treatment; those of the innominate artery, by Barrier; of the subclavian by Pétrequin; of the carotid by Dufour; and of the popliteal artery by Wiepce, Minor, Isaacs, and Lenoir. Aneurism of all sized arteries has been injected, from that of the supra-orbital artery, by Raoult and Deslongchamps; to the aorta itself, by Syme. The sum total at present exceeds thirty cases. But their results have not been sufficiently analyzed to draw any numerical conclusion for, or against, this kind of treatment. Injection succeeds in so far as it induces *coagulation*, rather than excites inflammation and its consequences. Such also is the favourable *modus operandi* of galvano-puncture.

TREATMENT OF TRAUMATIC ANEURISM.—The requisite operative procedures here also are governed by the pathology of this lesion.

In the first instance, traumatic aneurism is always a *diffused* and more or less pulsating collection of blood, communicating with an artery; this escape of blood having taken place, by a puncture or laceration, more or less complete, of the vessel; and with, or without, an external wound of the integuments. Such being the essential condition of traumatic aneurism; if the tumour be also enlarging—if it be *diffused*, and *diffusing*; the immediate and total arrest of the hæmorrhage, is necessary. For this purpose, no partial arrest of the current through the wounded artery—no mere retardation of the passage of blood, will suffice, as for idiopathic aneurism, in its early or circumscribed state. The *whole* force of the circulation through the artery, must be taken off, ere the hæmorrhage will cease, and the diffused aneurismal tumour cease to spread.

*Ligature*, therefore, of the artery *above and below* its wounded point, is the treatment indicated. This, however, is easier said than done, in most cases. A free incision into the tumour, will expose the half-coagulated blood and commingled textures, when the mass can be readily

\* *Instituzioni Chirurgiche*, 1813, pp. 68, 82, 124.

† *De l'Operation de l'Anévrysme*, 1831, p. 102.

‡ *Cyclop. of Practical Surgery*, Costello, 1841, vol. i. p. 218.

§ *Recueil de Lettres et de Mémoires*, 1844, p. 276.

|| *Bulletin de la Société de Chir.*, vol. iii. p. 524.

turned out; and recurrence of hæmorrhage during this procedure is guarded against, by an assistant compressing the artery on its cardiac side, and as near the tumour as is practicable. Having sponged the bottom of the cavity thus made; the bleeding orifice may be seen at once, or it will be discovered by a spirt of blood, when compression on the artery above is slightly, and momentarily, relaxed. This is the point for which the Surgeon seeks. The vessel must then be secured, by tying it on either side of the aperture; or if divided, by tying both ends. Here especially, difficulty is encountered; owing perhaps to inaccessibility of the artery, and also to its disorganized, although not degenerate state as in idiopathic aneurism. Failing to effectually control the hæmorrhage; plugging of the cavity, from the bleeding aperture outwards, will be necessary to completely arrest it. And this additional safeguard is unobjectionable, as the wound can only heal, for the most part, by granulating from the bottom.

If a traumatic aneurism has become *circumscribed*, thereby evincing a decided tendency to undergo the process of natural cure; then indeed the lesion so far resembling an idiopathic aneurism, it may be treated accordingly, by merely retarding the force of the circulation through the aneurismal artery. *Compression*, therefore, of the artery *above* the aneurism, or perhaps *direct* compression; and *ligature* on the *cardiac* side only, and at *some distance* from the tumour—*i.e.*, the Hunterian operation—are both eligible resources. If the circumscribed aneurism be of *small* size, compression alone may prove sufficient to retard the passage of blood; or that failing, the Hunterian operation will probably be an effectual check. This operation is often far more conveniently performed than any application of a ligature near the tumour. Thus, in the palm of the hand, where it would be difficult and hazardous to apply a ligature on either side of an aneurismal tumour, the brachial artery has been ligatured for a small circumscribed traumatic aneurism over the ball of the thumb, and cure was accomplished. (Erichsen.)

The application of a ligature, still on the cardiac side alone, but *near* the aneurism, is not forbidden by any structural condition of the artery. This procedure—Anel's operation—is appropriate, provided only that the force of the circulation through the aneurism can thus be sufficiently retarded. But, if the aneurism be, or become, of *large* size, although circumscribed; the force of the current preponderates over the arterial resistance, and the balance cannot be sufficiently restored by a ligature at any part of the artery, on its cardiac side alone. The treatment accordingly is again restricted to double ligature—one on either side of the bleeding aperture—by the operation already described; the old operation of Antyllus, as for *diffused* traumatic aneurism.

The treatment of traumatic aneurism unaccompanied by an external wound, will be considered in connexion with Complicated Fracture and Dislocation, respectively.

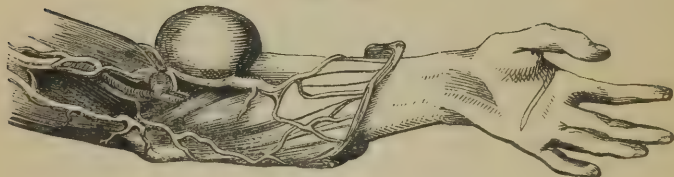
ANEURISMAL VARIX, AND VARICOSE ANEURISM.—*Structural conditions*.—An opening between an artery and a vein, in contact, whereby a *direct* communication of the two vessels is established, constitutes Aneurismal Varix. (Fig. 61.) Through this opening, the current of arterial blood, being the more forcible, passes, in part at least, into the opposing current of venous blood. Under favourable circumstances—to be presently explained—an *indirect* communication is established, by the formation of an intervening circumscribed false aneurism; this condition constituting

**Varicose Aneurism.** (Fig. 62.) It is so named from the varicose condition of the vein, with which the artery thence communicates. But the vein is varicose also in Aneurismal Varix.

FIG. 61.



FIG. 62.



*Signs.*—The same signs accompany either of these lesions, and they are very significant. Take, for example, a communication of the brachial artery and median basilic vein, occasioned by unskilful venesection; whereby both these vessels are punctured, as they cross at the bend of the elbow.

FIG. 63.



The superficial aperture in the vein and skin may soon have healed, but the deeper aperture in the vein and that in the artery remain open. The current of arterial blood being partly diverted from its course, is less forcible below the seat of injury, reducing the pulsation at the wrist to a feeble thread; and as the jetting stream passes through the median basilic vein into the veins of the forearm and arm, they become distended and tortuous, or varicose. The median vein, more especially, assumes an eel-like appearance down the forearm; while the median basilic and cephalic, the radial and ulnar veins, with the basilic and cephalic veins at the bend of the elbow, also exhibit in various degrees the force of the arterial current; they all become enlarged and varicose. (Fig. 63.) Aneurismal Varix simply, is formed, as the result of the puncture of both vein and artery; or, the jet of arterial blood passing into the vein, may burrow for itself a cavity in the intervening cellular tissue; forming a circumscribed false aneurism, as the medium of an indirect communication between the two vessels, and constituting Varicose Aneurism.

communication between the two vessels, and constituting Varicose Aneurism.

In either condition, the *varicose* state of the neighbouring veins con-



nected therewith, is the *earliest* and *most characteristic* appearance. The aneurismal swelling is wholly, or partly, formed, as the case may be, of enlarged and tortuous veins. And these veins, with, or without, the circumscribed aneurism, pulsate in unison with the arterial pulse; their pulsation being distinctly visible, perceptible also as a tremulous thrill, and audible as a soft, burring sound. Moreover, the whole swelling can be emptied by pressure upwards in the course of the veins, or it subsides and regains its former dimensions, when pressure is made on the artery. An elevated position of the limb will have the same effect. In the event of a circumscribed aneurism having formed, between the aperture in the artery and that in the vein; this portion of the swelling is at first soft and compressible, but it acquires a firmer and less elastic consistence, by the gradual deposition and consolidation of fibrine within the sac. If allowed to progressively enlarge, the skin shows the tint of venous obstruction, by assuming a livid hue; while the whole limb downwards from the seat of injury, becomes swollen, œdematous, feeble, numb, and cold, even threatening gangrene.

*Causes.*—The communication between an artery and a vein, is commonly of *traumatic* origin; as that produced by puncture in unskilful venesection at the bend of the elbow, or a lesion resulting from the thrust of a sharp instrument, or a ball in gunshot wound passing, between an adjoining artery and vein. But an opening may result from a diseased condition of the vessels, the lesion having an *idiopathic* origin; as in the bursting of an ordinary aneurism occasionally into a neighbouring vein. The *determining* cause of Aneurismal varix simply, or the formation of Varicose Aneurism, has reference to the anatomical relation of the artery and vein. Whenever the two vessels are in contact, a direct communication may be produced—giving rise to Aneurismal *Varix*; whenever the vessels are not in contact or in apposition, an indirect communication is established, by the formation of an intervening circumscribed false aneurism—constituting Varicose Aneurism. The latter is an additional condition. Aneurismal varix, or perchance, *plus* the intervening aneurism, may be produced in various parts of the body; wherever, a direct, or an indirect, communication can be established between an artery and vein of tolerable size. Therefore, with respect to the thigh, the ham, the neck, the arm, and in other situations, there are cases recorded. [P. p. 547.] But, the bend of the elbow, as already described, is the more common seat of these lesions, or it was so in the days of venesection.

*Course, and Consequences.*—Whether simply as Aneurismal varix, or as Varicose Aneurism, the vascular condition may remain stationary for years. There are cases of varix on record, which remained without further inconvenience for fourteen, twenty, and thirty-five years. But in all cases, the *tendency* is to gangrene of the limb or part, below the seat of communication between the artery and vein.

*Treatment.*—The more simple condition—*Aneurismal Varix*—requires treatment only in proportion to its progressive enlargement. In most cases, remaining stationary, for months or even years, and without any notable inconvenience, no remedial interference will be necessary.

The *prevention* of any further enlargement of the already aneurismally enlarged and tortuous veins, should be the first consideration. Moderate pressure, applied over the aperture of communication between the artery and vein, will, generally, be a sufficient restraint to counteract

any such tendency. A suitable compress should be worn, with an elastic bandage to support the veins below the aperture.

In exceptional cases, aneurismal varix undergoes *progressive enlargement*; at length attaining such size as to endanger the limb by gangrene, or the patient's life by hæmorrhage. Then indeed it becomes necessary to entirely stop the transmission of blood from the artery into the vein. No partial arrest, no mere retardation of the arterial current, will avail. Compression, whether applied directly over the aperture, or indirectly to the artery above the varix; or the Hunterian ligature applied higher up, would, therefore, alike be useless. The transmission of blood can be entirely precluded, only by cutting off all communication between the two vessels; namely, from above and below. Hence, the operation by double ligature of the artery, on either side of the aperture, is the only safeguard; the same as for a punctured wound of the vessel.

In the event of *Varicose Aneurism* having formed, this indication of treatment is the more imperative. A circumscribed false aneurism co-exists with the varix, and the sac has two apertures, placed also on opposite sides; thus freely transmitting a stream of blood continuously through the sac, and completely frustrating any tendency to the deposition of fibrine and spontaneous cure. Gangrene and hæmorrhage are both more imminent than in aneurismal varix.

*Operation.*—The application of double ligature under the circumstances of aneurismal varix, and of varicose aneurism especially, is attended with some slight difficulty. In either case, the considerable varicose enlargement of the vein, forming a fusiform pouch over the aperture in the artery, with tortuous eel-like communicating branches of vein, above and below, and the dilatation of the artery itself, above the aperture, together constitute a pathological condition which well-nigh effaces the mere surgical anatomy of, say—the bend of the elbow, in a case of aneurismal varix resulting from unskilful venesection. If an intervening aneurism be *superadded*, as between the brachial artery and median basilic vein, in the case supposed; if, in fact, there be a *varicose aneurism*, this pathological complication still further transforms the purely anatomical relations of the part. Thus, in performing the operation for double ligature, the first incision through the skin and which lays open the venous pouch, brings into view a cavity at the bottom of which an aperture is seen. But this is not the aperture for ligature; it leads into another cavity, the intervening aneurism, which must now, in its turn, be laid open, at the bottom of which there is another aperture, opposite to the former one; and that aperture, leading into the artery, is the one, on either side of which the vessel must be secured. The application of the ligature is often a proceeding of some difficulty also; owing to the dilatation of the artery on the cardiac side, and its equally contracted state below the aneurismal aperture. In an aneurismal varix from wound of the femoral artery and vein, Professor Pirrie found the former vessel enlarged to the size of a portion of small intestine.

Considering the difficulties of this apparently simple operation, it has been proposed, by Roux and Fergusson, to apply the ligatures without opening the sac.

The objection to any operation by double ligature, is the risk, that in curing the lesion itself, gangrene or hæmorrhage will more probably supervene, than when it is allowed to take its natural course.

Other kinds of treatment have been proposed, but less in accordance

with pathology, and practised, therefore, with less success. Thus, *galvano-puncture* has proved effectual; in one case, by Bosse, in another by Capeletti, but through suppuration; and a third instance of cure is recorded by Debout.\* The perchloride of iron *injection* was tried by Serres d'Alais, Jobert,† Vallette,‡ and Velpeau;§ in two cases only with complete success; in a third suppuration effected a cure; and a fourth case, was altogether unsuccessful.

## CHAPTER XXIV.

### ANEURISM, IDIOPATHIC AND TRAUMATIC, OF SPECIAL ARTERIES.

#### ARCH OF AORTA.

**ANEURISM.**—*Symptoms.*—In the *early* stage of aneurism affecting any portion of the thoracic Arch of the Aorta, the symptoms are singularly absent or equivocal. A bellows murmur, or an extension of the second sound of the heart over a certain area, with some dulness on percussion, may be the only discoverable symptoms to arouse suspicion. Any tumour or pulsation externally is quite imperceptible, excepting with reference to three portions of the arch.

1. *The anterior aspect of the ascending aorta.*—Pulsation may be perceptible by pressure between the intercostal spaces on the right side of the sternum, simulating the cardiac impulse, in addition and opposite to the seat of the true beat of the heart. As the aneurism increases, a tumour presents externally.

2. *The summit of the arch.*—A pulsating tumour appears behind the margin of the sternum, and rising into the neck, commonly towards the right side, may simulate aneurism of the brachio-cephalic or carotid arteries. But the tumour has no defined lower boundary, being continued downwards into the thorax; and impulse, with dulness on percussion and a bellows or whirring sound, are felt and heard there. I shall have occasion to again notice the diagnostic significance of these cervical aneurismal loculi or sacculations of the thoracic arch, in connexion with aneurisms of the innominate and carotid arteries springing from the arch, at the root of the neck.

3. *The posterior wall of the descending aorta.*—A pulsating tumour appears posteriorly, to one side of the spine or under the scapula, commonly on the left side, and attains the size perhaps of a man's head, ere it bursts.

Apart from these three situations of aortic thoracic aneurism; other aspects of the aorta, as for example, within the pericardium, or the concavity of the aorta, are so placed with relation to adjoining parts, that aneurism proves fatal before any pulsating tumour becomes perceptible.

*Pressure-effects*, therefore, vary with the particular situation of the aneurism, in its relation to surrounding parts, and according to its progressive size.

(1) *At the root of the aorta*, and particularly in the intrapericardial

\* Bulletin de Thérapeutique, 1847, p. 123.

† Bulletin de l'Acad. de Méd., 1854.   ‡ Ibid., May 23, 1859.   § Ibid. 1854.



portion; an aneurism can scarcely attain any size before death occurs, by rupture into the pericardium.

(2) At the *termination of the arch*, or the descending aorta; aneurism often attains considerable size without any particular pressure-effects. Dysphagia is, however, the special symptom, the œsophagus lying immediately to the right of the tumour.

(3) In the *concavity of the arch*, aneurism is beset with obstacles to its progress; notably, the bifurcation of the trachea, and either bronchus right or left, according to the inclining direction of the aneurismal enlargement. Dyspnoea is the urgent symptom, owing to the mechanical effect of pressure on the air tubes or pulmonary veins, or its influence on the left recurrent laryngeal nerve in its course round this portion of the aorta.

(4) On the *posterior aspect of the arch*, aneurism soon occasions dyspnoea, with, subsequently, dysphagia; the concurrence of these two symptoms, therefore, has diagnostic significance.

(5) At the *upper border, or convexity of the arch*, aneurism is attended with peculiar symptoms; cerebral disturbances, owing to interruption of the circulation through the carotid arteries.

(6) On the *anterior aspect of the arch*, aneurism is less productive of pressure-effects than in any other part; œdema, only, slowly supervening by compression of the innominate veins.

Pain is a symptom common to all these aneurisms, as it is to aneurism in general. While, therefore, it cannot be reckoned a special symptom, its character is in some respects peculiar. The pain may be piercing and intermittent or neuralgic; arising from pressure on the nerves—spinal or sympathetic. Affecting principally the left side, it darts up the side of the head and face, radiating down the arm to the elbow, through the chest, or piercing to the scapula. Or the pain may be grinding, burning, and continuous; owing to excavation of the tissues and bones. This kind of pain affects chiefly the right side of the chest. In every case, pain is a very early symptom, as compared with symptoms more special and characteristic.

*Diagnosis.*—The special symptoms thus indicated by the anatomical relation of these aneurisms, are variously combined; and, indeed, this sort of diagrammatic view of the aneurismal aortic arch is often modified so as to present the most perplexing cases of diagnosis; either as to the existence of aneurism, or the particular portion of the arch which may be affected. The former question can only be determined by the presence of a tumour, pulsating as an aneurism; and, therefore, with reference only to either of the *three* first-named portions of the arch, the part also being thus indicated. Presuming the existence of aneurismal tumour; the second question—as to its situation—may perhaps be solved by due consideration of the special symptoms of functional disturbance referable to the several *portions* of the aortic arch; which although less favourably circumstanced for physical diagnosis, are more conducive to the manifestations of functional disturbance. Fortunately, this differential diagnosis as to the part affected, guides the special prognosis more than it modifies the treatment of these *Aortic Aneurisms*.

*Treatment.*—The same principles which guide the treatment of aneurism in general, are here applicable, for the arrest, if possible, of thoracic aneurism in any part of the aortic arch; but any operative proceeding will obviously be out of the question.

ANEURISMS AT THE ROOT OF THE NECK.—*Diagnosis*.—These aneurisms are associated in virtue of their pathology, and their diagnosis. They are aneurisms of 1 the *innominate* artery, and 2 of the commencement of the *right common carotid* and *subclavian* arteries, respectively. Aneurism of the *thoracic* portion of the *left common carotid* or *subclavian* arteries, is unknown.

In the diagnosis of the aneurisms referred to, at the root of the neck, on the *right* side, the special symptoms of aneurisms of the aortic arch must be duly considered; but the difficulty will be to determine which of the three arteries is the seat of aneurism.

The observations of my colleague, Dr. Cockle—in his valuable contribution\* to our diagnostic knowledge of these aneurisms—are here to the purpose. “Whenever,” says he, “a pulsating tumour which involves the root of the neck to any extent is first submitted to observation, and is unaccompanied by a sufficiently accurate previous history, there is, generally a felt difficulty of diagnosis, whatever the actual *position* of the tumour may be. Such difficulty may occasionally arise from an inability to determine the real nature of the tumour, but most frequently (an aneurismal character being assumed), it consists in isolating the vessel engaged. The general rules laid down for guidance in this latter particular are based almost mainly upon the position of the tumour, and the relative state of the circulation in the corresponding arteries of the arm and neck.” These rules, as laid down by Mr. Wardrop, are as follow :—Aneurism at the root of the carotid artery, presents itself first, in the small triangular space between the heads of the sterno-mastoid muscle. Aneurism of the subclavian presents on the outer or cervical side; and, of the innominate, on the inner or tracheal side, of that muscle. Then again, the pulse in the radial or brachial artery, or in the carotid or temporal, is less on the aneurismal side of the body. Diminished pulsation in the neck may indicate aneurism of the carotid trunk; in the arm, that of the subclavian; while diminished pulsation in both situations, may indicate aneurism of the innominate artery.

But there are many exceptions to these general rules. Thus, the pulsating tumour of *aortic* aneurism may rise in the form of secondary sacculations ascending the neck, in the ordinary situation of innominate or carotid aneurism; and induce modifications in the circulation and sensibility of the right upper extremity. Or, instead of rising, an aortic aneurism may find its way amid the loose cellular texture of the thoracic mediastinum; but by compressing the innominate, carotid, or subclavian arteries, it will affect the pulse in the same situations as aneurism of these vessels.

Respecting *innominate* aneurism in particular; the differential diagnosis—observes Dr. Cockle—is attended with difficulties in tolerably direct proportion to the *part* of the trunk affected. “When the *origin* of the vessel is alone involved, it is—in his experience—invariably combined with aneurism, either true or false, of the ascending aorta. This form of innominate aneurism thus loses all individuality, and merges into the general pathology of aortic aneurism. It has absolutely no clinical history of its own. If, as at times, though with extraordinary rarity, an aneurism should limit itself to the *mid-portion* of the trunk and anterior wall, it may remain for a time, or even through its entire course, intra-thoracic, descending and moulding itself upon the aorta, evoking all

\* Med.-Chir. Trans., 1867.

the physical phenomena and symptoms of aneurism of the ascending and transverse aorta; or it may additionally, by one or more loculi, ascend the neck either on the tracheal or acromial side of the sterno-mastoid muscle. Should, therefore, a pulsating tumour with or without cervical extensions, occupy the space corresponding to the second and third costal cartilages of the right side and upper portion of the sternum, and present the ordinary symptoms of aneurism; though we may be practically safe in locating the disease in the aorta, it is not from any inherent difference of signs or symptoms, but from the rarity of intra-thoracic innominate aneurism.

"It is only when the *distal end* of the trunk becomes the seat of aneurism, that accuracy of diagnosis is attainable, though, in such case, the origins of the carotid and subclavian arteries often share the dilatation. Certain signs and symptoms are ascribed to innominate aneurism. Their value is high, in proportion as intra-thoracic disease can be eliminated; but extremely small, as the evidence for such disease increases. This is by far the most important point in diagnosis. The only possible source of error is the rare fact of an aortic sac arising from the convex wall of the arch, and mounting up the neck. Valuable aid is afforded by the knowledge of some antecedent local injury or violent and unusual effort; very many such cases being traumatic. These points determined; should severe pain of the right shoulder, clavicle, right side of the head, neck, and arm, with local venous congestion or œdema precede the appearance of a pulsating tumour, which, emerging from beneath the right sterno-clavicular articulation, and often displacing the head of the clavicle during its ascent, distends the space between the heads of the sterno-mastoid muscle, and fills the *epi-sternal notch*—should there be marked weakening of pulsation in the right radial and carotid arteries, pressure upon one or other artery loosening the impulse on the tumour—should a murmur, loudest over the tumour and at the sterno-clavicular articulation, diminish downwards, yet ascend the arteries on the right side, if pervious, such murmur being absent upon the left side; then, an aneurism of the *terminal* portion of the innominate artery may, with tolerable certainty, be diagnosed."

*Pressure-effects.*—Aneurisms of the innominate artery, and of the commencement of the carotid and subclavian arteries, produce the same pressure-effects—varying in degree—owing to their similar relations, for the most part, to surrounding structures. These effects have also a general resemblance to those produced by aneurisms of the aortic arch.

They are—dyspnœa, dysphagia, enlargement of the veins of the neck and right arm, with œdema, and pain.

*Dyspnœa* arises from the mechanical effect of pressure on the trachea, and in the case of innominate aneurism, possibly on the right bronchus; or from pressure on the right recurrent laryngeal nerve. The latter occasion of dyspnœa is accompanied with some husky modification of the voice, or loss of voice, paroxysmal cough and slight mucous expectoration. *Dysphagia* may be more or less complete. *Venous obstruction* is evinced by enlargement of the external jugular vein, the veins of the arm, and those below the clavicle in front of the right side of the chest. *Œdema* supervenes in the right eyelids, face, and head, and in the hand and arm. The *pain* has the usual heavy excavating character, in connexion with the tumour, and acute intermittent character from varying pressure on the cervical and brachial plexus of nerves; this pain shooting



up the right side of the neck, head, and face, spans the shoulder and front of the chest, and radiates down the arm to the hand. Some loss of muscular power in the right arm commonly supervenes.

The *diagnosis* from Tumours—not aneurismal—at the root of the neck, must be guided by the differential characters already described in connexion with ANEURISM.

*Causes.*—Aneurisms at the root of the neck are frequently traumatic; resulting from some violence, a blow, or strain in muscular exertion. Disease of the artery affected, predisposes, however, to the occurrence of such aneurism.

*Terminations.*—These aneurisms are invariably fatal, although in a variable period. The probable duration will depend on the particular direction the aneurism takes with relation to adjacent parts; and death occurs, usually by asphyxia, occasionally by rupture and repeated hæmorrhage.

*TREATMENT.*—Constitutional treatment—hygienic and medicinal as for Aneurism in general—is said to have proved successful in several instances. But, such resources having failed; the naturally fatal character of these aneurisms, renders the alternative consideration of operative proceedings unavoidable. Hence, the primary importance of a correct diagnosis of the particular vessel affected; either of the three vessels at the root of the neck, being, possibly the seat of aneurism.

1. *Innominate Aneurism.* — *Ligature*, on the *distal side*, may be resorted to; (a) of the subclavian artery alone; (b) of the carotid artery alone; (c) of both arteries. Neither of these modifications of Brasdor's operation for Aneurism has been followed by any notably successful results.

Distal ligature of the *subclavian* alone, has been practised in 3 cases; by Dupuytren, Langier, and Wardrop. The first two were fatal; the one on the 9th day from secondary hæmorrhage; the other, a month after operation, from asphyxia. In the third case, death occurred two years after operation, from exhaustion. The sac, in the first case, became smaller, the tumour diminishing, but its pulsations continued; in the second, the right carotid was obliterated by pressure of the tumour; in the third, the size and pulsation of the tumour diminished, but pulsation returned in the right carotid on the 9th day, thus apparently saving the life of the patient for two years. In any case, ligature beyond the *scaleni*, allows that portion of the current of blood through the aneurism to continue, which supplied the branches of the subclavian; namely, the superior intercostal, and internal mammary, the vertebral, and the thyroid axis. This direct transmission of blood in considerable quantity, not to mention that which passes off indirectly by the carotid artery, renders the probability of consolidation taking place in the sac, all but hopeless.

Distal ligature of the *carotid* alone, is not liable to this source of failure; no branch being given off from the parent trunk. The operation has been performed in 9 cases of innominate aneurism. In 8, a fatal result ensued in periods, varying from a few hours to a few days, or some months, even 20 months. Secondary hæmorrhage, asphyxia, and exhaustion, were apparently the causes of death consequent on the operation, excepting in two of the cases; one dying—a few hours after operation—from insufficient supply of blood to the brain; the other—on the 60th day—from hemiplegia. The only successful case, lived 34 years,

and possibly longer. The sac, in these cases, underwent consolidation in various degrees, the tumour and its pulsation diminishing accordingly; but this reparative change seemed to have no proportionate relation to the period after ligature. Thus, in one dying on the 7th day, the tumour was nearly filled with firm laminated coagulum; whereas, in another, on the 115th day, no alteration in the tumour had taken place. Suppuration in, and rupture of, the sac, occurred in one case; and also in the only case of recovery.

Distal ligature of *both* the carotid and subclavian arteries has been practised in four cases, by Fearn, Wickham, Rossi, and Christopher Heath. In the first two, the vessels were ligatured successively; an interval of two years, or of two months, elapsing between the operations. In the third case, the vessels were ligatured simultaneously. All were fatal; the first dying in three weeks after second operation, from pleurisy; the second, two and a half months after first bursting of the sac. The third case was fatal in six days, but remarkable for the patient having survived that time; the supply of blood to the brain being wholly cut off, otherwise than through the left vertebral artery. The sac in the first of these four cases—*i.e.* after two years—was found filled with dense organized coagulum; except a channel of the size of the artery, for the passage of blood. In the second case, the tumour diminished, after ligature of the carotid, but increased after ligature of the subclavian.

2. *Aneurisms of right carotid, and subclavian, arteries, at their origin—the root of the neck.*—*Ligature of the innominate artery.* This operation, in principle, applicable to either of these aneurisms, is impracticable in some cases; and has been fatal in its result with regard to all the cases in which it has hitherto been practised. Eleven such cases are recorded, the operation having been commenced but not completed in four other cases. All the eleven were fatal. Of these: 9 were cases of subclavian aneurism, the remaining 2, aneurism of both the subclavian and carotid arteries. In the former cases, death took place in periods, varying from the 5th day to the 67th day; and, with scarcely an exception, from secondary hæmorrhage; one died in 12 hours, also from hæmorrhage; but this case was a punctured wound in the axilla, for which the subclavian was ligatured and then the innominate artery. In one case only, on the 8th day, death resulted from inflammation of the aneurismal sac, lung and pleura. In the 2 cases of double aneurism, death occurred on the 9th and 34th days, but in both from accidental causes. In the 4 incompleated cases, the operation-difficulties were apparently, the large size of the aneurism, or the diseased state of the innominate.

*Carotid aneurism alone*,—at root of the neck. *Distal* ligature of the artery. Six cases are recorded by Norris;\* in 4 of which, the result was successful. This proportion is sufficient to justify a repetition of the operation, under favourable circumstances. In one case of traumatic aneurism of the carotid—at the root of the neck—arising from a stab in that situation, Mr. Syme performed the *old* operation for Aneurism; that of puncturing the sac, feeling with the finger in the sac for the aperture which controlled pulsation, then turning out the coagulum from the sac laid freely open, and securing the vessel by ligature above and below the aperture.

\* American Journ. Med. Sciences, vol. xiv.

*Subclavian aneurism alone*, at the root of the neck—*i.e.* situated either internal to, or between, the scaleni.—*Distal* ligature of the artery, in the *third* part of its course.—This operation has been proposed, but I am not aware that it has ever been practised.—The axillary artery below the clavicle, under the pectoral muscles, was ligatured by Dupuytren for subclavian aneurism; and this distal operation proved fatal, on the 9th day, from hæmorrhage. *Amputation* at the shoulder-joint, with, therefore, distal ligature of the artery, was suggested by Sir William Fergusson; the presumed advantage being, that the tumour might then be much more under the control of pressure, as the supply of blood below would no longer be requisite. This suggestion has not yet been tried; except in a case, by Mr. Spence of Edinburgh, and with a temporarily favourable result.

#### CAROTID ARTERY.

**ANEURISM.**—*Symptoms.*—The usual symptoms of an aneurismal tumour are present, and well-marked, owing to the situation of carotid aneurism. The pressure-effects are similar to those of carotid, subclavian, and innominate aneurisms, at the root of the neck, and those also of aneurisms of the aortic arch; so far as their anatomical relations are similar. Thus, the contiguity of the tumour to the trachea and œsophagus gives rise to increasing dyspnœa and dysphagia; compression of the recurrent laryngeal nerve occasions hoarseness or loss of voice; pressure on the cervical plexus is accompanied with some pain or loss of sensibility in the parts thence supplied; and there may be some giddiness or other cerebral disturbance, owing to interruption of the circulation through the aneurismal artery.

The *diagnosis* of carotid aneurism must have regard to the various kinds of pulsating tumour which are liable to occur in connexion with the carotid artery. Enlarged lymphatic glands, and tumours, especially cysts, and abscess, situated on, or communicating with the artery; may severally simulate aneurism.—They are all pulsating swellings; but differing in the less expansive character of the pulsation, and the incompleteness possibly, of the supposed aneurism. The history of the case will aid the diagnosis, as in that of abscess. The fluid, as well as the pulsating, character of any superimposed cyst or abscess, or when communicating with the artery, and virtually forming an aneurism, are the two conditions which require the utmost caution in diagnosis. Mr. Liston, once inadvertently punctured a cervical abscess, which, communicating with the carotid artery, had thus become converted into aneurism. Pulsating tumours present even more perplexing difficulty. Pulsating enlargement of the thyroid body differs from a supposed aneurism, in its situation, and more particularly, in the tumour moving up with the trachea in the act of deglutition. Any tumour, *not* communicating with the carotid artery, can be raised from the vessel, when the aneurismal symptoms will be found to cease; excepting the thrill of a pulsating tumour. Aneurismal varix of the internal jugular vein is an occasional question of diagnosis. In addition to the ordinary signs of varix, the notable diminution of the tumour during a deep inspiration, will perhaps determine the question.

*Causes.*—Carotid aneurism—unlike the aneurisms hitherto noticed, and in particular, innominate aneurism—is rarely traumatic. Hence, probably, the fact, that it occurs more frequently in the female than any



other external aneurism. In 25 cases, 12 were in women. But the comparatively early age at which it may occur is remarkable; in one instance, a girl of ten years, in another, of eighteen. The right carotid is more commonly affected than the left, and the upper portion of the vessel than the lower; the bifurcation being the chosen seat of carotid aneurism.

*Course and Terminations; and Prognosis.*—An unfavourable career may generally be predicated, owing to the proximity of carotid aneurism to the central force of circulation—the heart—and also its important anatomical relations in the neck. Rupture, with recurrent hæmorrhage, is one mode of termination; the tumour bursting externally, or into the pharynx or œsophagus. Asphyxia, by pressure on the larynx and recurrent nerve, is another termination. Starvation, by compression of the œsophagus, is yet a third issue, but not so imminent as either of the others. The particular part of the artery affected will materially modify the issue, and the duration of the case. It may be said generally, that the more distant the aneurism from the root of the neck, the less perilous are its pressure-effects, and the less imminent is any mode of fatal termination. Aneurism at the bifurcation of the carotid, below the angle of the jaw, may thus continue for years. At last, however, further want of space renders the contiguity of important parts increasingly perilous.

*Treatment.*—*Ligature*, on the *cardiac* side of the artery. This operation has certain important consequences relating to the brain, the lungs, and the aneurism.

In 149 cases—tabulated by Dr. Norris—54, or more than one-third, died. Of these, secondary hæmorrhage was the cause of death in 15 cases; gangrenous softening of the brain, with various disturbances of the cerebral functions, in 12 cases. The latter consequences evidently depend on the seriously diminished supply of blood to the brain by ligature of the common carotid trunk, leaving only the vertebral artery to carry on the circulation in the same half of the brain. The free anastomosis of arteries at the base of the brain—constituting the circle of Willis—does not seem to sufficiently compensate for this deficiency. But the consequences will of course be doubly perilous, if both common carotids be ligatured. The *symptoms* of cerebral disturbance are giddiness, paralysis, blindness, deafness, and convulsive movements; followed by stupor, coma, and death. Inflammatory symptoms sometimes follow the operation. Softening of the brain ensues from mal-nutrition depending on defective circulation. The *frequency* of cerebral symptoms is attested by the statistics of Ehrmann. Of 187 cases, in which one carotid was tied, 42 were followed by some kind of cerebral disturbance. In 213 cases—including ligature of both carotids, and those of the innominate artery—cerebral symptoms ensued in 47, or about 22 per cent.

The following conclusions—according to Mr. Erichsen—seem to be established. (1) Ligature of one carotid artery is followed by cerebral disturbance in about one-fifth of the cases, more than one-half of which are fatal. (2) Ligature of both carotids simultaneously, has always proved fatal; as in the two cases in which Mott and Langenbeck ligatured these vessels, an interval of only a few minutes elapsing between each operation. (3) Ligature of both carotids, an interval of some days or weeks elapsing, is not more frequently followed by cerebral disturbance than when only one is tied. (4) Obliteration of the vessels taking place gradually and successively, the patient may live; although one carotid

and one of the vertebrals have been occluded by disease and the other carotid ligatured, as in the case related by Rossi. (5) Occlusion of both carotids and both vertebrals, may yet allow life to continue for a considerable period, as in a case recorded by Dr. Davy; the cerebral circulation being maintained through the medium of the anastomoses of the intercostals and internal mammary arteries.

Congestion and inflammation of the lungs, is another affection not unfrequently consequent on ligature of the carotid. The explanation of this condition is difficult. It may arise from deficient influence of the brain or medulla oblongata in its relation to the respiratory movements. Suppuration of the sac is apt to occur as with other aneurisms, and even some weeks or months after the application of the ligature. Secondary hæmorrhage is another untoward event.

Recurrence of pulsation in the sac, soon after ligature of the common trunk—on the cardiac side—is not an uncommon nor unfavourable event. It would appear to depend on the free communication of the arteries from the opposite side of the brain, returning blood through the branches of the internal carotid above the sac. A collateral circulation, however, becomes established through branches of the subclavian on the same side. Thus, in a case related by Porter, after ligature of the right carotid, the subclavian and vertebral arteries were enlarged to double their normal diameters; the latter artery supplying the function of the internal carotid, and the inferior thyroid communicating freely with the superior thyroid artery.

WOUNDS, and TRAUMATIC ANEURISM, of the *Carotid Artery*.—*Ligature*, immediately above and below the seat of wound, is the appropriate operative procedure, as in wounds of other arteries.

ANEURISMAL VARIX of the *Carotid Artery and Jugular Vein*.—Resulting from punctured wounds in the neck implicating both these vessels, and in one instance, related by Mr. Macmurdo, consequent on disease; the signs, and the stationary character of this condition, are not peculiar to varix in this situation. No operative interference is requisite.

#### INTERNAL CAROTID.

EXTRA-CRANIAL ANEURISM.—*Symptoms*.—The internal carotid before its entrance into the carotid canal, may be the seat of aneurism. In situation, therefore, it nearly corresponds with aneurism of the common carotid at its bifurcation; but that of the internal carotid is situated under, or more immediately below, the angle of the jaw. The symptoms, also, are similar to those of common carotid aneurism, but there is a greater tendency to extension of the tumour inwards towards the pharynx, the direction of least resistance.

*Diagnosis*.—Internal carotid aneurism may thus simulate abscess of the tonsil. The marked pulsation of the tumour in its pharyngeal aspect, which can be both seen and felt expanding with each beat into the mouth, will principally determine the diagnosis.

*Treatment*.—*Digital pressure* on the common carotid, should be tried in the first instance. *Ligature* of that artery is the only available operative procedure, subsequently. Its results are uncertain.

INTRA-CRANIAL ANEURISM.—*Symptoms*.—Within the cranium, aneurismal dilatation of the internal carotid may occur in either of the three parts of its course; (1) in the carotid canal; (2) in the cavernous sinus; (3) in relation to the brain. Aneurisms of the other cerebral arteries

are conveniently associated with that of the carotid in the latter situation.

Of 62 cases noticed by Dr. Gull, the vertebral arteries and their branches were the seat of aneurism in 28, and the carotids and their branches in 34. The basilar artery was affected in 20 cases, and the middle cerebral in 15. In 8 cases, the internal carotid within the cavernous sinus was affected, and in 6 others the anterior cerebral artery.

(1) In the *cavernous sinus* the symptoms are mainly, those of aneurism, of pressure on the orbital nerves, and of disturbance of the cerebral circulation. Thus, arising, probably, from a blow or other injury, the person who is the subject of cavernous carotid aneurism, hears a sharp crack, followed by a sawing or rasping noise, which may also be heard by the stethoscope applied to the head or neck; but this sound ceases when pressure is made on the common carotid of the side affected. No tumour can be discovered externally. Pressure on the orbital nerves is announced, either by internal strabismus from paralysis of the sixth nerve,\* or by ptosis with external strabismus and dilated pupil from pressure on the third nerve,† or by loss of sensation in the parts supplied by the supra-orbital nerve.‡ The sense of vision usually remains unimpaired, or there may be double vision or other defect of sight. These affections of the orbital nerves exist singly or in combination. Cerebral disturbance is evinced by giddiness, headache, a sensation of fulness on stooping, and sleeplessness or disturbed sleep.

*Diagnosis.*—Similar symptoms may arise from any occasion of pressure on the artery in the sinus; as by coagula formed in the ophthalmic vein, the cavernous, circular, transverse, and superior petrosal sinuses. Otherwise the diagnosis of cavernous carotid aneurism can be made with tolerable certainty.

*Intra-orbital aneurism* is associated in point of situation and origin; the aneurism springing from the carotid artery, or, in some cases, from the ophthalmic branch. Anastomotic aneurism, or erectile tumour within the orbit, is an *independent* formation, and occurs more rarely; thus differing in its pathology from that of intra-orbital aneurism which was formerly regarded as an erectile growth. Mr. Busk§ has shown that many of these true aneurisms are traumatic; and Mr. Nunneley maintains that all are ordinary spontaneous or traumatic aneurisms, except those which have spread into the orbit from a *nævus* of the face.

*Diagnosis.*—The following general distinctions are adduced in evidence of this view:—Aneurism by anastomosis comes on gradually, mostly in early life, as the result of the growth of a congenital *nævus*; aneurism of the orbit very suddenly, often as the result of a blow, and almost always in advanced life; aneurism by anastomosis occurs in the sub-cutaneous tissues; aneurism of the orbit generally in the deepest part of the cavity; aneurism by anastomosis involves all the neighbouring vessels, arteries, and veins, in active disease; aneurism of the orbit is generally limited to a single part, or if the neighbouring vessels are dilated, they seem only enlarged from obstruction; ligature of the trunk of a vessel leading to an undoubted aneurism by anastomosis is an extremely unsuccessful operation; in aneurism of the orbit a very successful one; lastly, the cases dissected have turned out to be common

\* British Med. Journ., 1855.

† Path. Soc. Trans., vol. xii.

‡ Ibid.

§ Med.-Chir. Trans., vol. xxii.



aneurism. The diagnosis of *anastomotic* aneurism may perhaps be determined—as in Travers' and Dalrymple's cases—by the presence of soft, compressible, thrilling tumours in various parts of the eyelids; collections of veins apparently, transmitting pulsation from the subjacent aneurism.

(2) *At the base, or in the substance of the brain*, aneurism of the cerebral branches of the internal carotid, or of other cerebral arteries, is liable to occur. The symptoms, if any, are very equivocal; pressure arising possibly from other causes than cerebral aneurism, and the diagnosis, therefore, is equally obscure. The sensation of a sawing or rasping noise in the head, varying with the circulation, and which probably has supervened shortly after some injury, may be suggestive of aneurism; a suspicion corroborated, perhaps, by careful auscultation of the head, leading to the detection of a bruit.

*Diagnosis.*—Symptoms referable to pressure may arise from any other tumour; and similar symptoms ensue from softening of the brain. Hence, general or partial paralysis, blindness, deafness, or other affections of the special senses; are symptoms of an equivocal character.

*Causes.*—A blow, a fall, or other traumatic mode of origin can be traced, in some cases; in others, the symptoms seem to arise spontaneously, without any previous ill-health. The cerebral arteries are said to be healthy, in most cases; but this is improbable. Age notably affects the liability to intra-cranial aneurism; the tendency increasing as life advances. Of 58 cases, in 12 only this condition occurred under twenty-five years of age, 5 of whom were under twenty; but of the remaining 46 cases, 13 occurred in persons under forty, 29 between forty and sixty, and 4 in persons above sixty. Sex seems to be predisposing, probably in connexion with occupation. Of the 58 cases, 35 were males, 23 females.

*Course and Terminations.*—The pressure of an intra-cranial aneurism is followed by softening of the portion of brain, or cranial nerve, in contact; and, possibly, absorption of any opposing portion of bone. The symptoms of paralysis supervene. Death ensues, by hemiplegia, or apoplexy by rupture of the aneurismal sac; the latter mode of death occurring more frequently in earlier life. According to Dr. Gull's table, in 20 cases of persons under thirty-five years of age, 16, or 80 per cent. died from rupture of the sac; while in 37 cases above thirty-five years, 14 or 38 per cent. only, terminated fatally in this way.

After death, much of the pathology of these aneurisms is made known by internal examination which could not be discovered during life, clinically, and which, therefore, cannot be applied in diagnosis. Generally, the aneurism is found to be a dilatation of the whole circumference of the artery, rather than a truly sacculated portion. Coagulation and the deposition of laminated fibrine, may have proceeded to the almost complete spontaneous cure of the aneurism. Usually not larger in size than a pea or Barcelona nut, the aneurism is sometimes much larger, having attained the size of a walnut or hen's egg. Rupture may have occurred in quite the smaller-sized aneurism. One aneurism only is found, rarely more. Thus, in one case, both carotids were dilated into bulbs occupying the hollow on each side of the sella Turcica, and which were filled with laminated coagulum. The preparation is in the museum of the College of Surgeons.

*Treatment.*—*Digital pressure* on the common carotid artery, may be

sufficient to overcome the symptoms wherever intra-cranial aneurism is situated; and it has also proved successful in intra-orbital aneurism, under the care of Gioppi and Vanzetti. When this method of treatment has failed, *ligature* of the common carotid is the only known resource. It was signally successful in the case of a woman aged fifty-five, under Mr. Coe, of Bristol.\* After ligature of the left carotid, the cranial bruit ceased, a gentle continuous murmur followed, due apparently to the flow of blood through the tumour from the anastomosing branches; this subsided in about five hours, and all the symptoms ceased permanently. Great success has attended this operation in intra-orbital aneurism. Out of 20 cases, 14 were successful, 2 partially so, in 1 the pulsation continued, and 3 died. In other 13 cases, 12 were cured. A case is also related by Mr. Hart,† of arterio-venous aneurism in the orbit which was thus cured. Digital pressure would seem to be at least advantageous in any case, as preparatory to ligature; dilatation of the collateral arteries preventing the otherwise untoward symptoms which are apt to follow the latter proceeding.

WOUNDS, and TRAUMATIC ANEURISM, *of the Internal or External Carotid, and their branches.*—*Ligature above and below* the seat of wound, may, perhaps, be impracticable, owing to the situation of the wounded vessel; or having failed to permanently arrest the hæmorrhage, the *common carotid* must be tied. The latter operation has certainly been successful in some cases. Traumatic aneurism having formed, will, of course, render ligature *in situ* more difficult; but even here branches of either carotid, situated superficially, may be thus secured. The temporal artery, for example, has been wounded in cupping on the temple, and given rise to traumatic aneurism; but as being a distal branch of the external carotid and readily accessible, the tumour can be laid open, its contents turned out, and the vessel tied on either side of the aperture.

#### SUBCLAVIAN ARTERY.

ANEURISM.—*Symptoms.*—Aneurism of the subclavian artery presents a pulsating tumour situated immediately *above* the clavicle, and commonly external to the margin of the sterno-mastoid muscle, the third part of the subclavian usually being affected. Its apparent size varies with the position of the shoulder, for the tumour disappears partly below the clavicle when the shoulder is raised. Pressure on the brachial plexus is accompanied with pain, and numbness down the arm even to the fingers; and the phrenic nerve also sometimes becoming disturbed, there may be spasmodic action of the diaphragm—hiccup, as an occasional symptom. The external jugular and subclavian veins suffering compression; œdema, particularly of the hand and arm, will be conspicuous in most cases.

*Diagnosis.*—Other tumours may occasion similar symptoms; their *differential* characters, compared with those of aneurism, should therefore be remembered in considering the diagnosis. (See TUMOURS IN THE NECK.)

*Causes.*—A traumatic origin can, generally, be traced—*e.g.*, a blow, fall on the shoulder, or violent muscular exertion of the arm. Hence, the more frequent occurrence of subclavian aneurism on the right side, and, perhaps, in connexion with an occupation requiring constant use of the right arm; and, certainly, the far greater liability of males

\* Brit. Med. Journ., 1855.

† Lancet, March, 1862.

than females. In 32 cases, 2 only occurred in females, and both from injury.

*Course and Terminations.*—Slowly increasing in size, the tumour ultimately attains large dimensions; occupying the space between the clavicle and trapezius muscle. Never passing inwards, the trachea and œsophagus escape pressure; neither dyspnœa nor dysphagia supervene. But the tumour may extend somewhat downwards, and thus encroach on the apex of the lung. Extending yet further, upwards or downwards, the aneurism bursts externally, or internally with hæmorrhage into the pleura. Rarely, subclavian aneurism undergoes a spontaneous cure; the sac becoming consolidated with laminated fibrine.

*Treatment.*—*Ligature of the subclavian*, on the cardiac side, in the *first* part of its course. This operation has been practised for the cure of subclavian aneurism—in the third part of the vessel—*i.e.*, beyond the scaleni, and when situated between these muscles—the second part. In the 8 cases recorded, all were fatal, in periods varying from the 4th to the 13th and 36th day; and uniformly from hæmorrhage, excepting in one case, where death occurred from pericarditis and pleurisy.

Ligature of the *innominate* artery, has also been fatal in every instance. The results of the 11 cases in which this operation was performed, have already been noticed. Nine were cases of subclavian aneurism, the remaining two, aneurism of both the subclavian and carotid arteries. (See Aneurisms at the root of the neck.)

*WOUNDS, and TRAUMATIC ANEURISM, of the Subclavian.*—Punctured wounds are occasionally met with, as a sword-thrust, or stab with a knife. Such a wound of the subclavian artery is usually fatal, before sufficient time has elapsed for traumatic aneurism to arise.

ANEURISMAL VARIX *of the subclavian artery and vein*, has been known to occur, in like manner.

#### AXILLARY ARTERY.

ANEURISM.—*Symptoms.*—The situation of the pulsating tumour of Axillary Aneurism is characteristic. It arises immediately *below* the clavicle, under the great pectoral muscle, or under the anterior fold of the axilla, if the second, or third, portion of the artery be the seat of aneurism. Pressure on the brachial plexus occasions pain and numbness extending down the arm and hand; œdema of the upper extremity also occurs from pressure on the axillary vein. But, the situation of the tumour distinguishes it from subclavian aneurism, a very important distinction as to the portion of artery eligible for ligature.

*Diagnosis.*—Other tumours may be recognised by their *differential* characters. An abscess pulsating over the subjacent artery, resembles aneurism in situation, but differs in the antecedent symptoms of inflammation. Pulsating tumour of the head of the humerus resembles aneurism in symptoms varying only in degree, but differs in situation, for it presents on the front of the shoulder.

*Causes.*—A blow, or fall, on the shoulder, violent movement, or other injury, to the joint; is the mode of origin traceable in most cases. Forceful extension in the endeavour to reduce old-standing dislocations of the shoulder, has furnished some instances of axillary aneurism, by rupture of the artery with the adhesions betwixt it and the bone. The traumatic origin of the aneurism renders its occurrence more frequent



on the right, than the left, side; and more common in men than women. Of 37 cases, 3 only happened in females.

*Course and Terminations.*—Enlarging rapidly in the loose cellular texture of the axilla, the aneurism extends downwards and forwards; occupying the whole axillary space, and thus acquiring a larger size than aneurism in most other situations. Or it may take an upward direction, elevating the shoulder, or projecting above the clavicle into the angular space between it and the trapezius muscle. At length, rupture takes place, externally, or internally into the pleura or lung. Spontaneous cure has never been known to occur.

*Treatment.*—*Compression* of the subclavian, in the third part of its course; may be either impracticable, owing to elevation of the shoulder or the projection upwards of the tumour, or it will be unendurable, owing to the unavoidable compression of the brachial plexus.

*Ligature* of the subclavian, in the *third* part of its course. This operation is the only resource, but its results have been most disastrous. In 48 cases of axillary aneurism, unconnected with any external wound; ligature of the third part of the subclavian terminated fatally in 25, while 23 were cured, a nearly equal proportion, or only 1 in 2. The causes of death consequent on the operation were, in some respects, peculiar. Inflammation within the chest in 10 cases; suppuration of the sac, in 6; hæmorrhage in 3; suppurative phlebitis, 1; gangrene of hand and arm, 1; general gangrene, 1; not stated, 3. If we extend the statistics of this operation to all cases, including ligature for aneurism, the results are equally discouraging. Of 69 cases, tabulated by Norris,\* 33, against 36, died, about the same proportion as after the operation for aneurism. In 6 cases, more recently,† operated on in London, 2 only recovered. Porta's table of 74 cases, is slightly more favourable than the returns of the same cases by Norris, *minus* the few additions. But the average mortality of ligature of the subclavian in the third part, in all cases taken indiscriminately, would appear to be considerably above 40 per cent.!

*WOUNDS, and TRAUMATIC ANEURISM, of the Axillary Artery.*—*Ligature*, *above* and *below* the puncture in, or division of, the vessel, is the appropriate operation. It was performed by Mr. Syme‡ in a case of ruptured axillary artery. Ligature of the artery *below the clavicle*, or of the *subclavian* above, must be had recourse to in cases where the previous operation is impracticable, owing to the great depth of the artery or other operative difficulty, or in the event of secondary hæmorrhage. Of 15 cases in which a ligature was applied below, or above, the clavicle; 9 were successful, and 6 died.

#### BRACHIAL, RADIAL, AND ULNAR ARTERIES.

*ANEURISM.*—The axilla is the limit below which spontaneous aneurism rarely occurs in the upper extremity. But it has been met with in the brachial artery, and in this vessel at the bend of the elbow; in the radial and ulnar arteries, and as low down as the ball of the thumb. Aneurism in any such situation is readily recognised by the ordinary symptoms, and can scarcely be mistaken for anything else.

*Causes.*—Some injury is usually the immediate cause, but the vessel, probably, was previously diseased. This was the condition in an aneu-

\* Amer. Journ. Med. Science, 1845.

† Med. Times and Gaz., 1856, vol. ii., 1860, vol. i.

‡ Med.-Chir. Trans., vol. xliii.

rism of the upper part of the ulnar artery, under the care of Mr. De Morgan at the Middlesex Hospital. The traumatic origin of these aneurisms can generally be discovered in their history. An old ship-carpenter, whilst at work, felt as if something had snapped in his arm. Mr. Liston ligatured the brachial artery. Aneurism of the radial artery at the ball of the thumb has followed an attempted reduction of dislocation.

*Course and Termination.*—These aneurisms rarely attain any considerable size, and may undergo a spontaneous cure. An aneurism of the radial artery, in a patient under Mr. De Morgan, recovered spontaneously.

*Treatment.*—*Compression* of the artery above the aneurism, is available wherever the situation offers ready resistance, and it can be borne. As regards the brachial artery; the round form of the humerus, and the nerves of the brachial plexus, forbid compression. *Digital pressure* may be available; and in the aneurism referred to, of the ulnar artery, this mode of compression maintained by the patient himself as long as he was able for several days, much reduced the size and pulsation of the tumour. On all these aneurisms, compression tells more effectually than in those of larger sized arteries.

*Ligature* of the artery, above the aneurism. Thus, the brachial may be tied for aneurism at the bend of the elbow; the ulnar or radial for aneurism of these arteries; and the latter, if the aneurism be situated at the ball of the thumb. Ligature of the brachial artery is usually very successful as regards the issue of the operation itself. In 68 cases—tabulated by Porta—10 died after the operation, but whether in consequence of it is uncertain.

WOUNDS, and TRAUMATIC ANEURISM of these Arteries.—These lesions are as common as spontaneous aneurism of the same vessels is rare.

The *Treatment* is the same as for similar lesions of other arteries.

*Double ligature* of the vessel at the seat of injury; or that failing, *ligature* of the artery *above*. *Compression*, by means of a graduated compress, applied in the seat of wound, or above, if an aneurism have formed, might be tried in the first instance; but it will rarely prove sufficient to permanently arrest the hæmorrhage. This method of treatment is most successful in wounds of the palmar arch, there being a steady resistance to the compress by the metacarpal bones. But it may become necessary to tie the radial and ulnar arteries, and subsequently even to ligature the brachial.

ANEURISMAL VARIX, AND VARICOSE ANEURISM.—These conditions mostly occur at the bend of the elbow; the brachial artery and median basilic vein communicating, by puncture in unskilful venesection. Seldom met with, therefore, in these days of almost abandoned general blood-letting, the rules of treatment should still be remembered in the event of any such accident happening.

*Compression*, with an accurately applied compress and roller, over the puncture, will generally succeed in restraining aneurismal varix. But, after considerable enlargement of the vein—varix being established, or the formation of an intervening sac—varicose aneurism; it will be necessary to completely cut off the current of arterial blood, by *ligature* of the artery on either side of the aperture of communication.

Any other operative proceeding would be ligature of the arterial trunk *above*; an alternative rendered necessary only by impracticability of the operation *in situ*, and which is not so directly effectual.

### ABDOMINAL AORTA; AND ILIAC ARTERIES, COMMON, INTERNAL, AND EXTERNAL.

**ANEURISM.—Symptoms.**—The symptoms of abdominal or pelvic aneurism, are similar to those of aneurism in other situations. A tumour, the pulsations of which can be felt, heard, and perhaps seen externally; compressible, and subsiding if pressure can be made on the arterial trunk above. The pressure-effects are various, according to the relations of the tumour to adjacent viscera; pain also and œdema supervene as the nerves and venous trunks suffer compression. Thus, in parts supplied by the lumbar plexus, pain is experienced—*e.g.*, down the thigh and leg, if the anterior crural nerve be stretched over the tumour; while œdema of the limb is occasioned by pressure on the vena cava, common or external iliac veins.

**Diagnosis.**—Other tumours may give rise to analogous symptoms.

Internal *abscess*, pulsating perhaps, in connexion with the aorta or iliac arteries, must be remembered as an occasional source of serious error in diagnosis. The distinction between abdominal or pelvic aneurism and *pulsatile tumours of bone*, is most difficult.

The following characters seem to be generally distinctive, though seldom or never present collectively. In pulsatile tumours of bone; (1) the bruit is less marked or absent; (2) the pulsation is more sudden, less heaving and expansive, and equally forcible whether the tumour be large or small; while in aneurism, the force of pulsation is proportionate to the size of the tumour; (3) The bone connected with a pulsatile tumour is expanded, thus presenting a considerable osseous enlargement around the seat of disease—*e.g.*, the ilium on either side of a tumour developed in it; an aneurism simply eating an aperture, the margin of which may be felt if the tumour can be made to collapse. Osseous swelling determined the diagnosis of a pulsatile tumour of the ilium, in St. George's Hospital; the tumour projecting at the sacro-sciatic foramen and simulating aneurism of the gluteal artery. In a case recorded by Mr. Stanley,\* a plate of bone was found in the walls of the tumour; (4) Pulsatile tumour of bone is very commonly cancerous, and accompanied therefore with other evidence of this disease.

The *seat* of abdominal or pelvic aneurism—*i.e.*, the particular artery affected—will obviously be an important consideration in relation to treatment by any operative proceeding.

**Treatment.**—*Compression* of the artery above the aneurism, is practicable only in very thin persons, and those who can bear prolonged compression of the aorta against the vertebral column. It can be effected, instrumentally by means of a pad-compressor, or by digital pressure.

**Ligature of the abdominal Aorta.**—This desperate operation has been practised in 5 cases. By Sir A. Cooper, in 1817; and subsequently, by James, of Exeter; by Murray, at the Cape of Good Hope; by Monteiro, at Rio Janeiro; and by South, of London. All the cases were fatal, and as the result of the operation; the 1st case, dying in 40 hours; the 2nd, in the evening of the operation day; the 3rd, in 23 hours; the 4th, on the 10th day; and the 5th, in 43 hours.

Such having been the unexceptional fatality of this operation, the particulars of the cases themselves are comparatively unimportant. Sir

\* Med.-Chir. Trans., vol. xxviii.



A. Cooper's case was an aneurism of the left common iliac artery and some portion of the vessel below. Mr. James's case was *inguinal* aneurism, for which he had previously performed the distal operation. Monteiro's case was a large false aneurism in the lower and right side of the abdomen; the patient dying—on the 10th day—from secondary hæmorrhage.

*Ligature of the common iliac.*—This operation has not been uniformly fatal in its results. In 32 cases, collected by Dr. Stephen Smith,\* 25 died, 7 only recovered. But this list comprised ligature of the artery for all causes, including aneurism. Thus, (1) for arrest of hæmorrhage in wounds, or in surgical operations, 11 cases, 10 deaths; (2) for aneurism, 15 cases, 10 deaths; (3) for pulsating tumour mistaken for aneurism, 4 cases, 1 recovery; (4) to obviate hæmorrhage in an operation in 1 case, and in an aneurism for anastomosis in another, making 2 cases, both of which died. The causes of death were noted in 19 cases; gangrene in only 3, exhaustion 8, hæmorrhage 6, and peritonitis 2. Five more cases may be added to Dr. Smith's table; 3 of which were fatal, and 2 successful, one by Bickersteth, of Liverpool, the other by Syme, in which he laid open the sac of an iliac aneurism, and tied the common, external, and internal, iliac arteries opening into it.

Out of the total number of cases of ligature of the common iliac, 37; 28 have died, and 9 only recovered; in 9 the peritoneum was wounded, and of these, 8 were fatal.

#### GLUTEAL, SCIATIC, AND PUDIC ARTERIES.

**ANEURISM.**—*Symptoms.*—The three chief branches of the internal iliac artery are, each, liable to spontaneous aneurism; but the sciatic and pudic arteries are very rarely affected. An aneurism of the pudic artery is preserved in the Museum of the College of Surgeons. It is about the size of a walnut, and contains laminated fibrine.

The *gluteal* artery is more liable to aneurism. Its symptoms are not peculiar; but the situation of the pulsating tumour is the posterior part of the buttock, where the gluteal artery emerges from the sacro-sciatic notch of the ilium.

As compared with pulsatile tumour of the ilium, the *diagnosis* must be guided by the distinctions already noticed. Encephaloid cancer may simulate aneurism, as happened in a case under the care of Mr. Guthrie,† who thence ligatured the common iliac artery.

*Treatment.*—*Ligature of the internal iliac.*—This operation, first performed in 1812, by Dr. Stevens, has since been repeated in 9 other cases. Of these 5 were unsuccessful, 4 successful, including one wherein the peritoneum was accidentally wounded.

**WOUNDS, and TRAUMATIC ANEURISM of the gluteal artery.**—Diffused aneurism of enormous size may follow a wound of the gluteal artery. The famous case of punctured wound of this vessel, with consequent aneurism, as related by John Bell, well illustrates the character of aneurism thus arising over the buttock. [P. p. 207.]

*Treatment.*—*Double ligature* of the vessel at the seat of injury. This operation proved thoroughly successful in the above case. The incision over the tumour was two feet in length, and eight pounds of blood were turned out of the sac; but the man ultimately "walked stoutly" and regained good health. In a case operated on by Mr. Syme,‡ the base of the

\* Amer. Journ. Med. Sciences, July, 1860.

† Med.-Chir. Trans., vol. xxviii.

‡ Obs. Clin. Surg., 1861.

tumour had attained the size of a man's head, it occupied the whole hip, and rose into a blunt cone. The result was successful.

#### COMMON FEMORAL ARTERY.

**ANEURISM.**—*Symptoms.*—The pulsating tumour of aneurism of the common femoral trunk, arises in the groin, but, it may pass partly upwards into the abdomen. Situated, otherwise, external to the pelvis, the characters of aneurism are more readily perceptible, than when the tumour is internal. Its pressure-effects are evinced by pain in the groin and down the thigh, the genito-crural and branches of the anterior crural nerves being affected; and œdema of the leg supervenes, owing to compression of the femoral and saphena veins.

The *diagnosis* must still have regard to the possibility of abscess or a cyst pulsating in connexion with the artery; and that of a pulsating tumour of the ilium. Inguinal aneurism has been punctured by mistake for abscess; and cases of pulsating tumour simulating aneurism in the groin, have occurred to both Mr. Stanley and Mr. Syme. But the pulse below an aneurism, as compared with the pulse in the other limb, is reduced; and this distinction will aid in determining the diagnosis of a pulsating tumour.

*Causes.*—A blow, strain, or other injury, has seemed to be the immediate cause of inguinal aneurism, in some cases.

*Course and Terminations.*—Restrained by the fascia lata, in the thigh, and by the pelvic fascia above, the tumour enlarges slowly, but may ultimately attain a large size. It is said never to become diffused, the fascia effectually circumscribing the aneurism; but it acquires a lobulated character under the unequal resistance thus offered to the increasing tumour.

A spontaneous cure has been known to take place in a few instances.

*Treatment.*—*Compression on the external iliac.*—This proceeding is practicable in persons not too stout, and has proved sufficiently successful to encourage a repetition. *Digital* compression was effectual in a case under Mr. Fox, of the Pennsylvania Hospital; the want of assistants, however, prevented him from thus completing the cure. Another case—in St. George's Hospital—was entirely cured by mixed digital and mechanical compression.

*Ligature of the external iliac.*—First performed by Abernethy, in 1796, this operation has since been practised in at least 100 cases, according to Norris's table. Of these, 73 were cured, and 27 died. In 92 cases, the aneurism was seated entirely in the groin; and of these, 70 were cured, and 22 died. The causes of death were partly referable to the operation; gangrene of the limb, in 8; secondary hæmorrhage, in 4; sloughing of the sac, in 3; from tetanus, 3; and from more general causes, 4. Inguinal with popliteal aneurism of the same side, co-existed in a few of these cases. This complication does not appear to lessen the efficacy of the operation. Of 4 such cases, ligature of the external iliac was successful in 3; the one dying of gangrene, but the popliteal aneurism, in that case, was about to burst at the time of operation. In 118 cases of ligature for all purposes, including aneurism, 33 died; and in 30 of these, 13 died of gangrene, 6 of secondary hæmorrhage, 3 of sloughing of the sac, 2 of tetanus, 2 of prostration, 2 of peritonitis, 1 of

diffuse inflammation, and 1 of delirium tremens. Of the remaining 2 out of 33; one death was unconnected with the operation, and in the other case the cause is not specified.

Pulsation returned in the sac in 6 of the aneurismal cases; several weeks after the operation in some cases, and followed by death in only 1 case. In 2 of the three successful cases after ligature for double aneurism on the same side, pulsation returned in the inguinal aneurism; but it ceased, after a while, in both.

*Ligature of the common iliac*, must be had recourse to, if the aneurism extends beneath Poupart's ligament into the pelvis, or partially involves the external iliac.

WOUNDS, and TRAUMATIC ANEURISM of the *Common Femoral Artery*.—*Double ligature* of the vessel at the seat of the injury, is the rule of treatment established by Guthrie's observations in this, as in all similar cases. The artery being wounded so near to Poupart's ligament, hæmorrhage will of course be more perilous, owing to the great difficulty of compressing the vessel above, in applying the ligatures.

Secondary hæmorrhage also and gangrene are both imminent subsequently.

*Amputation* is the only resource in either of these events; ligature of the external iliac has invariably failed to prevent the recurrence of secondary hæmorrhage.

ANEURISMAL VARIX, and VARICOSE ANEURISM, in the *groin*.—*Double ligature*; the tumour having been laid open, and the aperture of communication between the vessels, sought. This operative proceeding is recommended by Guthrie, as for varix and varicose aneurism occurring in other situations. But the unavoidably perilous hæmorrhage, in seeking the aperture of communication between the femoral artery and vein, will always be a most serious consideration; for it will be found impossible to safely control the hæmorrhage during the operation, by compressing the artery above.

*Ligature of the external iliac*—the alternative operation—has, on the other hand, failed entirely. In the 4 cases recorded, a fatal termination was referable to the operation; 2 dying of secondary hæmorrhage, and 2 of gangrene.

#### FEMORAL ARTERY—DEEP, AND SUPERFICIAL.

ANEURISM.—*Symptoms*.—The *deep* femoral artery is very rarely the seat of aneurism. Two cases only can I find recorded; one by Mr. Bryant, in a patient of Mr. Cock's, at Guy's Hospital; the other under the care of Dr. Garrod, at University College Hospital. In the former case, the aneurism was at the origin of the deep femoral, in the latter, lower down. The symptoms of aneurism thus situated, are necessarily somewhat obscured by the depth of the artery.

The *superficial* femoral artery is rarely the seat of aneurism, but far more frequently than the deep femoral; and as affecting this artery, it is known as Femoral Aneurism. The symptoms are more perceptible—the tumour being more superficial; particularly if situated in Scarpa's triangle, the usual situation. Aneurism springing from this—the first portion of the femoral—is unsupported by muscles immediately behind it; thus forming more readily and rapidly, it presents a pulsating tumour, having the characters of aneurism well defined. They are obscured only by the fascia lata, superficial fascia, and integument. Aneurism arising



from the second portion of the femoral—within Hunter's canal—is not only more deeply placed, but is supported by the adductor muscles, and resisted by the aponeurotic covering of the canal, and by the superimposed sartorius muscle; as well as the fascia lata, superficial fascia, and integument. The pulsating tumour, therefore, has characters less distinctly aneurismal.

The *Pressure-effects* of femoral aneurism — whichever portion of the artery be affected—will consist in the pain and œdema produced by compression of branches of the anterior crural nerve, and of the femoral and saphena veins. In Hunter's canal, the internal saphenous nerve—a branch of the anterior crural, and the femoral vein, are here peculiarly subject to pressure.

*Treatment.*—*Compression* of the *common femoral*, in the groin, should always be tried in the first instance. It has been known to succeed, even when the aneurism has burst and become diffused. If the tumour continue to increase, the establishment of a tolerably free collateral circulation will prepare the way for the next resource.

*Ligature of the common femoral*, in the groin.—The results of this operation are decidedly unfavourable. Secondary hæmorrhage is apt to follow, owing apparently to the contiguity of arterial branches—the circumflex ilii above and the deep femoral below the ligature; the free communication of which vessels is, however, requisite for the collateral circulation. Gangrene, on the other hand, is apt to ensue; in the event of the arterial trunk becoming occluded below the ligature, thus shutting off the supply of blood through the deep femoral, as well as through the superficial femoral leading to the aneurism. Of 12 cases, in which the common femoral has been ligated; secondary hæmorrhage occurred in 9, 3 of which were fatal, and 6 were saved only by ligature of the external iliac; the remaining 3 were successful.

*Ligature of the superficial femoral* will be practicable only in cases where the portion of this artery, between the sac below, and origin of the deep femoral above is of sufficient length for the application of a ligature. But this operation avoids both the sources of danger consequent on ligature of the common femoral. Ligature of the superficial femoral, in the part referred to, may be eligible for aneurism situated in the apex of Scarpa's triangle, and would certainly be appropriate for aneurism in Hunter's canal.

*WOUNDS, and TRAUMATIC ANEURISM of the Femoral Artery.*—These lesions are liable to happen by puncture with some sharp instrument, or by rupture, or penetration of the artery, with or by fracture of the femur.

Cases of this description are not very uncommon. The following instance well illustrates the symptoms. The femoral artery of a young man was wounded with a penknife. On the following day—observes John Bell—aneurism began to form, but as yet the wounded artery was not so far removed from the fascia and surface of the thigh but that pure blood found its way out through the integuments, and he lost at a few strokes of the heart no less than three pounds of blood; but on the third day, the coagula were so firm, the wounded artery so deeply buried under the coagulating blood, and the external wound so steadily compressed, that it healed. Then, the aneurism assumed its proper form of a great pulsating tumour, but circumscribed, and limited to the upper and fore part of the thigh; very little swelling of the limb had supervened after the lapse of three weeks. In another case, a man was sitting in a careless

way cutting a rag or flaw from the root of his nail, and the scissors, which were very sharp-pointed, dropping betwixt his thighs, he suddenly clapped his knees together to catch them, and struck the points into his thigh, wounding the femoral. The blood instantly spurted out, was soon stopped, and the external wound healed in a few days; then aneurism began to form.

The *Treatment* presents nothing peculiar;—*double ligature* of the artery at the seat of wound; or, if secondary hæmorrhage occurs, *ligature of the trunk* above should be had recourse to.

ANEURISMAL VARIX, and VARICOSE ANEURISM, in the thigh.—In the event of either such possible mode of communication between the femoral artery and vein, the treatment would be analogous to that for similar conditions of the common femoral artery and vein in the groin.

#### POPLITEAL ARTERY.

ANEURISM.—*Symptoms*.—Popliteal Aneurism is declared by a pulsating tumour, which forms in the popliteal space, or ham. At first, small, circumscribed and of roundish shape, soft and compressible, it subsides also by pressure on the femoral trunk. This latter symptom, as Sir A. Cooper originally observed, may be more readily perceived by looking at the tumour from the level of the limb. The pulsation, like that of other external aneurisms, can be seen and felt, as well as heard, transmitting a *bruit*. But the character of the pulsation is modified by the aspect of the artery, whence the aneurism springs. When it arises from the posterior aspect of the vessel, towards the skin, popliteal aneurism has the usual heaving and expansive character; arising from the anterior aspect towards the joint, the aneurism raises the vessel more to the surface, and the pulsation is thrilling; the beat of the vessel; also, in its course, being, perhaps, felt distinctly separate.

The *pressure-effects* of popliteal aneurism are, as with other aneurisms, pain and œdema, preceded by some stiffness of the knee-joint, and a semi-flexed position of the limb. Lameness is, indeed, often one of the earliest symptoms of the disease.

The *diagnosis* is usually unequivocal. But the pain and inability to use the joint may be mistaken for rheumatism; and other tumours in connexion with the popliteal artery, have a pulsatile character transmitted to them—*e.g.*, chronic abscess, a cyst, or solid tumour, in the popliteal space. The pulsation, however, is less expansive, the tumour incompressible, and it does not subside on pressure of the femoral trunk. These differences disappear in the event of aneurism having undergone consolidation; thus so far resembling a solid tumour. But any such independent tumour can, perhaps, be lifted off, and isolated from the artery, when its pulsatile and apparently aneurismal character ceases. The history of the case will aid in determining the diagnosis; as, for example, with regard to chronic abscess.

*Causes*.—Some strain in flexion or extension of the joint seems to be the usual mode of origin. Hence, popliteal aneurism occurs more frequently in persons accustomed to the athletic exercises of running or jumping, or who ride hard on horseback. Sailors, according to Dr. Crisp, would appear to be more subject to the disease than any other class. Men, generally, are far more liable than females. Of 155 cases, in Norris's table, 5 only were females. The *period of life* most liable is between thirty and fifty. As compared with other aneurisms, popliteal aneurism is far

less frequently associated with a diseased state of the arterial system, and with aneurism, consequently, in other parts of the body. Both popliteal arteries are affected with equal frequency, and occasionally at the same time. On the other hand, compared with other arteries, the popliteal is prone to aneurism. Thus, of 551 cases of aneurism, collected by Dr. Crisp, 137 were popliteal, and only 66 femoral.

*Course and Terminations.*—Enlarging usually with tolerable rapidity, the aspect of the artery from which the aneurism arises, regulates the rate of its progress. On the anterior aspect of the vessel, aneurism is resisted by the joint or the lower end of the femur, and increases slowly. Constant pressure on these parts is followed by synovitis or caries, and the tumour ultimately bursts into the joint. On the posterior aspect of the vessel, aneurism being supported by the hamstring muscles on either side, but restrained only by the integuments, it enlarges rapidly. Becoming diffused, it may burst upwards into the cellular texture of the thigh; or backwards, under the integuments of the popliteal space; or downwards, under the fascia overlying the posterior tibial vessels and nerve.

Rupture of the sac terminates the previous aneurismal symptoms.

*Treatment.*—*Genuflexion*, first employed successfully by Mr. Ernest Hart, should be tried, in the first instance. If bending the knee back upon the thigh stops the pulsation in the tumour, this treatment may be continued. The limb having been bandaged from the toes nearly to the knee, the roller should be turned round the thigh, flexed at an acute angle; the limb is then bent upon the pelvis, and the knee rested against a pillow. In Mr. Hart's case, the cure had made considerable advance after the first day of flexion, and was complete on the fourth day; on the seventh the patient was moving about. Other successful cases have since been recorded.

Flexion is, in fact, a mode of compression; this being the next resource when that has failed, or is ineligible owing to the large size of the aneurism.

*Compression of the femoral artery.*—Instrumental or digital compression may be readily effected; care being taken that the pressure be directed rather outwards against the femur, as the vessel winds to the inner side of the bone in its course down the thigh to become popliteal. But this kind of treatment may be unbearable. Or, the tumour still enlarging, compression will no longer prove sufficient to induce consolidation of the aneurism, and still less so, if the sac has burst, and diffused aneurism being established, gangrene is imminent.

*Ligature of the superficial femoral.*—This operative proceeding becomes necessary under the circumstances adverse to compression, or its continuance. Ligature of the superficial femoral has been attended with more successful results than that of any other main artery. The vessel is usually secured at the apex of Scarpa's triangle, just as it passes under the sartorius muscle.

In 110 cases, collected by Dr. Crisp, 12 only had a fatal issue; by secondary hæmorrhage, 4; by gangrene, 3; and the remainder dying of phlebitis, tetanus, &c. Of 33 cases operated on in London, Hutchinson shows that 10 were fatal; 5 dying from gangrene. This would seem to be the chief cause of death after ligature of the femoral for all purposes, including popliteal aneurism. Thus, of 204 such operations in Norris's tables, 50 died. Of these, the cause of death is omitted in 4; but of the remaining 46, 23 or one-half, died from gangrene, and 8 only from



hæmorrhage; 5 of phlebitis; 1 from sloughing of the sac, and the residue from accidental causes common to all operations, as tetanus, pyæmia, &c. Return of pulsation in the sac sometimes occurs, but it rarely is of much consequence. Compression of the artery above, will, mostly, control any such unfavourable tendency.

Secondary hæmorrhage may be met by ligature of the artery above—*i.e.*, the common femoral, or the external iliac; pressure with a graduated compress fixed over the bleeding aperture, or double ligature of the vessel *in situ*, will be insufficient or impracticable; and, in extreme cases, amputation is the only resource.

*Amputation of the limb.*—This operation must be resorted to in the event of *gangrene*, consequent on the aneurism, or its having become diffused, or after ligature of the superficial femoral. Persistent secondary hæmorrhage will also render amputation unavoidable. Limited gangrene may allow the preservation of the limb.

Amputation has proved tolerably successful in its results, more so than ligature of the femoral, taking either operation in all cases indiscriminately. Of 50 cases of ligature collected by Mr. Hutchinson from the practice of the metropolitan hospitals, 16 died, or nearly one-third; whereas, amputation of the thigh—in all the cases collected by Mr. Bryant from Guy's Hospital, and by Mr. Holmes from St. George's Hospital—shows a mortality considerably below one-third.

DOUBLE POPLITEAL ANEURISM.—*Compression* seems to Mr. Erichsen specially appropriate in double popliteal aneurism, as thus to avoid that disturbance of the balance of the circulation which is certain to ensue when one vessel is ligatured, and which may act injuriously upon the opposite aneurism.

*Ligature* of the artery has occasionally been practised with advantage on both sides; either simultaneously, or, with more safety, consecutively.

WOUNDS, and TRAUMATIC ANEURISM of the Popliteal Artery.—Should either of these lesions occur, they would present nothing peculiar as to symptoms or treatment.

Rupture of the artery, subcutaneously, has been met with. In one case, *double ligature* of the vessel was performed by Mr. Poland,\* with an unsuccessful result, gangrene having supervened on the third day, followed by amputation and death. But no difficulty was experienced in the operation. The only two other cases wherein double ligature of the popliteal has been attempted, failed in the operation. Ligature of the femoral has been tried in two cases, both of which terminated fatally by gangrene. In one case, accompanied with rupture of the popliteal vein, which occurred in my own practice, gangrene ensued, for which *amputation* was performed above the knee, with, however, a fatal result. (Page 258.)

#### TIBIAL ARTERIES—ANTERIOR AND POSTERIOR.

ANEURISM.—*Symptoms.*—Very rarely, spontaneous aneurism occurs below the knee, in connexion with either of the tibial arteries. A small aneurism of the posterior tibial is preserved as a preparation in the Museum of St. George's Hospital. The symptoms will probably be obscure, owing to the small size of any such aneurism, and its depth from the surface; especially as connected with the posterior tibial, throughout the greater portion of the course of that vessel.

\* Guy's Hosp. Reports, 3rd series, vol. vi.

The *Treatment* must be conducted on the same principles as for aneurism in other situations; *compression* above the tumour, when practicable; or, that having failed, *ligature* of the *femoral* should be duly considered, with reference to the probability of curing the aneurism and also the consequent perils of this operation.

WOUNDS, and TRAUMATIC ANEURISM.—*Double ligature* of the vessel, at the seat of wound, or resulting aneurism, is unquestionably, as in all similar cases, the appropriate rule of treatment. But this operative procedure may be rendered impracticable by the depth of the vessel, especially in a muscular limb, and increased by the infiltration of blood. Under these circumstances, other procedures have, occasionally, been resorted to; and, in the event of secondary hæmorrhage, they must be taken into consideration.

*Ligature of the popliteal or femoral artery*, has thus proved successful in arresting hæmorrhage. Wound of the posterior tibial, with secondary hæmorrhage, warranted ligature of the popliteal artery, in a case under the care of Samuel Cooper; and diffused traumatic aneurism of the same vessel, seemed to justify ligature of the femoral, in a case under Dupuytren.

*Amputation* should always be the last resource.

ANEURISMAL VARIX, and VARICOSE ANEURISM.—The latter condition has occurred in the posterior tibial artery and one of the *venæ comites*, just above the internal annular ligament at the ankle-joint. The two vessels communicated through a small circumscribed aneurism intervening between them. No history, I believe, could be ascertained; this varicose aneurism having been discovered by Mr. Cadge in the dissecting room of University College, when he was Demonstrator of Anatomy in that Institution; and I well remember he showed me the specimen, which is, I believe, unique.

## CHAPTER XXV.

### LIGATURE OF ARTERIES.

OPERATIONS for the Ligature of Arteries are more conveniently and instructively described, consecutively; rather than severally, in connexion with the various Aneurisms to which these Operations pertain.

Thus viewing the Arterial System, Surgically, the similarity of anatomical relations in contiguous portions of the same artery, will save much unnecessary repetition, which would otherwise be unavoidable, in describing the operations for their ligature.

Certain *general directions* are applicable to the ligature of all arteries; and they relate either to the operation as performed on an artery in its continuity, or at the seat of a wound involving an artery.

LIGATURE OF AN ARTERY IN ITS CONTINUITY.—This operation consists in dividing the textures down to the artery, and then applying a ligature around the vessel. A muscle or tendon, or perhaps a bone, is observed as the recognised guide for the *incision*. Thus, the inner border of the biceps muscle guides to the brachial artery, the tendon of the supinator longus leads to the radial, and the upper margin of the clavicle, in its outer third, is the line of incision leading to the subclavian in the third

part of its course. In the absence of any such anatomical "directing line," a line can, mostly, be drawn corresponding to the course of the artery. For example, midway between the anterior superior spinous process of the ilium and symphysis of the pubes, a line commencing, and terminating on the inner side of the patella, nearly indicates the course of the femoral artery.

The *incision* may be made in the line thus indicated naturally or artificially, or obliquely across that line; the latter direction guiding to the artery which it bisects in some point of its course, and leading more clearly to the parts adjacent on either side of the vessel. The *length* of incision should be proportionate to the depth of the artery, which has to be reached, thence varying from one to three inches or more; but generally the skin alone should be first divided, the integument being gently stretched, without displacement, by the fingers of the left hand. Then, the subjacent fascia, its superficial and deep layers, and muscle in some cases, must be carefully divided, in succession; any known veins or arterial branches being avoided, if possible, or hæmorrhage from them commanded by pressure, torsion or ligature. Adjoining the artery, a nerve may be found, lying by the side of the vessel, but outside its sheath—*e.g.*, the ulnar nerve in collateral relation to the ulnar artery; or several nerves may surround the vessel, as the brachial plexus in relation to the brachial artery. Any such superficial vessels, the border of a muscle or tendon, and nerves, are conveniently drawn to one side and protected, and the wound made more open, by curved metallic spatulæ; wherewith retraction can be gently maintained by an assistant, as the textures are successively divided; and also during the passage of the ligature-needle around the artery.

The *sheath* of the artery having been reached—as denoted by its dense cellular character, and the pulsation of the enclosed vessel, immediately beneath the finger—that structure should be slightly raised with the forceps, into a small cone off the artery, and the knife being laid flat under the pinch of the forceps, a small aperture is cut in this portion of the sheath. The artery thus exposed, through the aperture, will be recognised by its whitish-yellow or fawn colour. Enclosed within the sheath, by the side of the artery, lies the small companion vein, or two such veins, *venæ comites*, one on either side, in relation to a second-sized artery. It, or they, have a dark-blue colour, contrasting with the colour of the artery; but any enclosed vein may be only partially visible through the small aperture in the sheath. A nerve also is sometimes enclosed, as the pneumogastric within the sheath of the carotid, but it has less immediate relation to the artery; while external to the sheath, the collateral nerve or nerves already referred to will be seen, in immediate relation to the artery.

An *aneurism-needle*, armed with a waxed silk ligature, is introduced (Fig. 64) through the aperture in the sheath, between the vein and artery, and turned round the latter; their cellular connexion having, previously, been gently separated, if necessary,

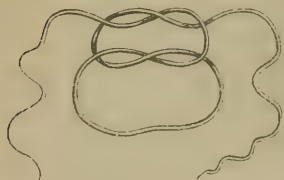
FIG. 64.





by scratching with the point of the needle. The *ligature* is drawn out from the eye of the needle, and the needle itself withdrawn; leaving one end of the thread on either side of the artery.

FIG. 65.



Special care should be observed not to slide the ligature up and down the artery, nor to lift up the vessel much from its bed; whereby, in either way, the nutrient *vasa vasorum* would be cut or torn off, endangering sloughing of the vessel and secondary hæmorrhage. The ligature should be tied transversely round the artery, as an oblique direction of the noose would be liable to loosen; the ends of the thread must be drawn moderately tight, so as to divide the two inner coats of the vessel, and then the thread tied again forming a reef-knot (Fig. 65).

It must be observed in these proceedings, that the *vein* be not wounded or transixed, nor any adjacent *nerve* included in the ligature with the artery. But care should also be taken, not to ligature any extraneous structure *instead* of the vessel; as a nerve, or portion of the sheath. The finger placed on the *distal* side of the artery will at once discover whether pulsation is stopped, and the vessel secured. One end of the ligature is then to be snipped off close to the knot on the vessel, and the other end left hanging out of the wound, guarded by a small strip of adhesive plaster; and lastly, a piece of wet lint is placed over the incision.

**LIGATURE OF AN ARTERY AT THE SEAT OF A WOUND, INVOLVING THE VESSEL.**—The wound is here used as the incision, leading down to the artery. It may require to be enlarged, as in the case of a punctured or other narrow wound; and much difficulty may be experienced in finding the vessel, owing to the infiltration of surrounding textures with blood. The artery may be found *punctured*, or completely *divided*. In either case, the rule of treatment for securing it and arresting hæmorrhage, is the same.

A ligature must be applied on either side of the aperture, or to either cut extremity; this *double ligature* being necessary to control the hæmorrhage from the distal, as well as the cardiac end of the artery—which would otherwise continue to bleed by the anastomotic supply of blood from above the upper ligature.

Puncture, or division, of an arterial branch *close* to the *trunk* whence it springs, is equivalent to an aperture in that vessel of equal size to the branch or the puncture in it. The same treatment therefore will be requisite; ligature of the trunk above and below the branch.

Ligature of an artery, on the *surface* of a wound—*e.g.*, a stump after amputation—has been described in connexion with INCISED WOUNDS.

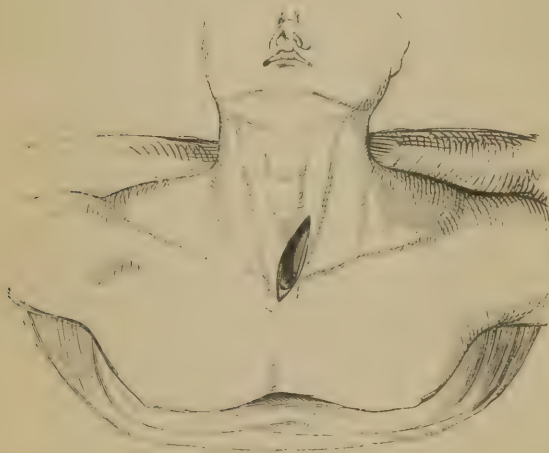
The Ligature of Arteries will now be described severally, and in consecutive order from the commencement of the Arterial System to the Extremities; associating with each such Operation a preparatory summary of the Surgical Anatomy of the Artery.

**LIGATURE OF THE INNOMINATE OR BRACHIO-CEPHALIC ARTERY.**—*Surgical Anatomy.*—This artery *arises* from the commencement of the transverse portion of the arch of the aorta, and ascends *obliquely* to the right, as high as the *sterno-clavicular* articulation; where it divides into right subclavian and right carotid arteries. Its *length* is, usually, an inch and a half to two inches. Situated within the thorax, behind the first piece of the sternum; the vessel is immediately *overlaid*—from below upwards—

by the left innominate vein, crossing its root, the sterno-hyoid and sterno-thyroid muscles; and above it passes between and behind the cellular interval of the sternal and clavicular portions of the sterno-mastoid muscle. *Posterior* to the artery, is the trachea, on which it lies, obliquely; on its *left* side, is the left carotid artery, but as the innominate ascends to the right, a considerable interval separates the two vessels, in which appears the trachea, with some remains of the thymus gland; on the *right* side is the right innominate vein. Nearly parallel with the artery, and along the outer side of the vein is the phrenic nerve and the pleura. The pneumogastric nerve, entering the thorax, between the subclavian artery and innominate vein, gives off its recurrent branch around that artery, and then dips backwards by the side of the trachea, to lie in the interval between that tube and the œsophagus. This nerve, therefore, has no immediate relation to the innominate artery, otherwise than just as the nerve enters the thorax behind the vein and to the right of the artery, here lying on the right side of the trachea.

*Operation.*—The innominate may be reached from *above* the sternum. The patient being placed in the recumbent position, and the head thrown well back, exposing the root of the neck; an incision is commenced in the epi-sternal notch near the right sterno-clavicular articulation, and carried upwards to the left, for about three inches, near the inner side of the left sterno-mastoid muscle. (Fig. 66.) A second incision, if necessary, may be made from over the sternal origin of the right sterno-

FIG. 66.



mastoid muscle, meeting the lower end of the first incision at nearly a right angle. The skin and superficial fascia are thus divided, and if a flap of integument has been formed by the second incision, it is turned up; the deep fascia is cautiously divided, and the finger passed down the trachea to the artery; or, if a flap be made, the sternal origin of the right sterno-mastoid muscle and a few fibres of the sterno-thyroid and hyoid muscles, may also be divided; and the root of the carotid thus exposed, is followed down to the innominate. A round curved aneurism-

needle, armed with a ligature, is then passed around the vessel, and the ligature secured, with all the skill the Surgeon can command. A needle having a point which can be detached, when felt under the vessel, may help to facilitate this critical part of the operation.

The innominate has been reached *anteriorly*, by removing a piece of the sternum and sternal end of the clavicle. This was done by Cooper of San Francisco,\* in a case where the upper end of the innominate artery itself was diseased, and the aneurism affected the *root* of the subclavian and carotid arteries. But it is only for the cure of aneurisms in that situation, that ligature of the innominate would ever be contemplated; and disease of any portion of this vessel—the seat of operation—would be a positively forbidding condition. In the case referred to, and in all instances of the less formidable operation, above the sternum, the result has been fatal.

LIGATURE OF THE COMMON CAROTID.—*Surgical Anatomy*.—The right and left common carotid arteries differ only in part of their course; that portion of the latter vessel which extends from its origin on the arch of the aorta to the left sterno-clavicular articulation, or the thoracic portion of the left common carotid. But this part of the left carotid artery is never selected for ligature.

The common carotid on the *right* side, and the cervical portion of the *left* common carotid, extends from behind the *sterno-clavicular* articulation to the upper border of the *thyroid cartilage*; where it divides into *external* and *internal* carotid arteries. The artery has an *oblique direction* upwards and outwards; corresponding to a line drawn from the sterno-clavicular articulation to a point midway between the angle of the jaw and the mastoid process of the temporal bone. It seems to have an inclination backwards, superiorly, owing to the projection forward of the larynx, in that situation. The artery with the internal jugular vein and pneumogastric nerve, are enclosed in a common membranous *sheath*, continuous with the deep cervical fascia. The vein, within this sheath, is situated along the outside of the artery, a thin cellular partition only intervening; the nerve lies behind and between the two vessels. Thus so far isolated, the artery is deeply placed at the lower part of the neck, and more superficial above. *Below*, the sheath is *covered* by the sterno-mastoid, sterno-hyoid, and sterno-thyroid muscles, and crossed by the omo-hyoid muscle obliquely upwards just below the cricoid cartilage. Superficial to these muscles, is the skin and superficial fascia, and a small portion of the platysma myoides as it passes upwards from the clavicle to the lower jaw; the deep cervical fascia ensheathing the muscles and passing down behind them, continuous with the sheath of the vessels, into the thorax. Crossing the sheath is the middle thyroid vein. *Above* the cricoid cartilage, the artery is covered only by the skin and superficial fascia, platysma and deep fascia. Crossing the sheath here are the superior thyroid veins, which sometimes form a plexus in this situation. The descendens noni, a branch of the hypoglossal nerve, lies on the sheath of the vessels from above downwards, inclining from the outer to the inner side. Occasionally, this nerve runs within the sheath, and between the artery and vein. *Posteriorly*, the artery, throughout its course is supported by the transverse processes of the cervical vertebræ; a thin stratum of muscle intervening, consisting of the longus colli and scalenus anticus. The sympathetic and recurrent laryngeal nerves, and

\* Amer. Journ. Med. Sciences, Oct. 1859.



inferior thyroid artery, are also in relation with the posterior aspect of the artery. On the *inner* side of the artery; below, lie the trachea with the thyroid body, which often overlays the vessel; above, the larynx and the pharynx. On the *outer* side is a chain of lymphatic glands, between the sheath and the inner border of the sterno-mastoid muscle, which corresponds to the artery in the upper part of its course. Within the *sheath*, the large internal jugular vein is in immediate relation, on the outer side of the vessel.

*Operation.*—The patient should be placed in the recumbent position, with the head thrown back, and the face turned a little from the side of operation; thus exposing the side of the neck. The *apex* of the carotid triangle, where the omo-hyoid muscle crosses the artery, is selected, if possible, as the seat of ligature; the inner margin of the sterno-mastoid muscle being the guide to the artery. An incision, from two to three

FIG. 67.

inches long, on the inner edge of this muscle, should be so placed that the centre about corresponds to the lower border of the cricoid cartilage. (Fig. 67.) The skin, superficial fascia, and platysma, are thus divided. Turning the head a little so as to relax the sterno-mastoid, the deep fascia must be cautiously divided, and the sheath of the vessels exposed, with the omo-hyoid crossing it. The thyroid veins, turgid with blood, passing across the sheath of the vessels, and the descendens noni lying in front of the sheath, are drawn to either side of the wound with spatulæ by an assistant. The operator introducing his



finger into the wound, feels the artery beating between the trachea and sterno-mastoid muscle. The sheath is now opened in the usual way, by a pinch up with the forceps and lateral application of the knife; the aneurism-needle should be gently insinuated, on the outer side of the artery, between it and the vein, taking care not to include the pneumogastric nerve in dipping the needle round the vessel; the ligature is then drawn through and secured, without disturbing the vessel.

The operation *lower* down in the neck, necessitates the division of the sternal portion of the sterno-mastoid muscle. The sterno-hyoid and thyroid muscles may be drawn to the outer side. Any thyroid veins and the internal jugular, which, on the left side, inclines to the front of the artery, will also thus be avoided; and the ligature is then passed as above.

LIGATURE OF THE EXTERNAL, AND INTERNAL, CAROTID.—*Surgical Anatomy.*—(1) The *external* carotid arising from the *bifurcation* of the common carotid, opposite the upper border of the thyroid cartilage, extends upwards to the neck of the *condyle* of the lower jaw, between it and the

mastoid process; there dividing into two branches, the temporal and internal maxillary arteries. In this course, it lies, at first, on the *inner* side of the internal carotid, and then superficial to that vessel. But its *depth* varies below and above the *digastric muscle*, or a line drawn from the mastoid process to the hyoid bone.

Below that muscle or line, the external carotid is *covered* only by the skin and superficial fascia, the platysma, and deep fascia; then, passing beneath the digastric and stylo-hyoid muscles and hypoglossal nerve, which cross obliquely, the artery enters the substance of the parotid gland, beneath the fascial nerve and the external jugular vein. Here then the artery is deepest, and inaccessible. *Posteriorly*, the artery rests on the pharynx, and the superior laryngeal nerve; and above the angle of the jaw, on the styloid process and glosso-pharyngeal nerve, which separate it from the internal carotid. To the *inner* side, is the pharynx, and above, the ramus of the jaw and stylo-maxillary ligament. On the *outer* side, the internal carotid lies parallel with the external carotid, at the origin of the two vessels; but this relationship is soon lost, as the external vessel becomes more superficial in passing to its destination. More externally, the inner edge of the sterno-mastoid muscle corresponds to the artery.

(2) The *internal carotid*, arising from the *bifurcation* of the common trunk, extends upwards to the *carotid foramen* in the temporal bone; and there, passing through the carotid canal in that bone, it enters the *cranium*. The cervical portion, limited by the carotid foramen, varies in *depth*—like the external carotid—with its relation to the *digastric muscle*. Below that muscle, the artery is *covered* only by the skin and superficial fascia, platysma, and deep fascia; then passing beneath the external carotid, separated by the styloid process and glosso-pharyngeal nerve—at the angle of the jaw—it lies under the deep surface of the parotid gland, until it enters the carotid foramen. *Posteriorly*, the artery rests on the transverse processes of the upper cervical vertebrae; the rectus anticus major muscle, sympathetic and superior laryngeal nerves, intervening. *Internally*, the pharynx and tonsil are in contact; and the ascending pharyngeal artery runs up, on the pharynx, between the vessel and the external carotid. *Externally*, the internal jugular vein runs side by side with the artery, and the pneumogastric nerve behind and between the two; these structures having the same relation as to the common carotid, of which the internal carotid seems to be the continuation. The hypoglossal nerve comes forward between the vein and artery, and passes inwards over the latter to gain the lower border of the digastric muscle, over the external carotid; thus crossing both arteries superficially. The inner margin of the sterno-mastoid muscle corresponds to the artery, externally.

*Operation*.—The neck must be well exposed as for the ligature of the common carotid. Guided by the *sterno-mastoid*, an incision along its inner margin—from the angle of the jaw to just above the level of the thyroid cartilage—will lead down to the *internal carotid*; and a little more internally, to the *external carotid*. The digastric muscle and hypoglossal nerve crossing the latter near the upper angle of the incision, identify this artery. A small aperture is made in the sheath of the vessel to be ligatured, and an aneurism-needle passed betwixt it and the vein; as in the operation on the common carotid.

LIGATURE OF THE LINGUAL ARTERY.—*Surgical Anatomy*.—*Arising* from the inner aspect of the external carotid, between the superior thyroid and

fascial branches; the lingual passes slightly upwards and inwards to the great cornu of the hyoid bone; and above it, continues forwards beneath the hyoglossus muscle, at the anterior border of which it gives a branch—sublingual, to the sublingual gland; and then *terminates* as the *ranine* branch, along the outer side of the genio-hyoglossus, extending to the tip of the tongue. Having this somewhat tortuous *direction*, the artery is comparatively superficial below and above the great cornu of the hyoid bone, in this part of its course being *covered* only by the skin, platysma, and fascia; but it is then crossed by the digastric and stylohyoid muscles passing to the body of the hyoid bone, and the artery enters deeply beneath the muscles; it is concealed entirely by the mylohyoid, as well as overlaid in part by the hyoglossus. *Resting* on the middle constrictor of the pharynx, the vessel afterwards lies on the geniohyoglossus muscle, *beneath* the hyoglossus, and in its course as the ranine artery under the tongue. The hypoglossal nerve, winding round the lower border of the posterior belly of the digastric muscle, passes upwards beneath it, and approaching the posterior margin of the hyoglossus muscle, the nerve is there situated above the lingual artery; continued *over* that muscle to its anterior margin, the nerve has become inferior, and there sinks into the fibres of the genio-hyoglossus muscle, the artery-*ranine* lying on the muscle.

*Operation.*—The lingual artery can be more readily reached, if necessary, in the *superficial* part of its course; and the upper border of the great cornu of the hyoid bone will guide to the artery in an accessible situation. Having placed the head so as to expose the digastric triangle under the jaw; an oblique incision should be made from below the symphysis of the jaw, over the cornu of the hyoid bone, to the border of the sterno-mastoid. (Fig. 69, *f*.) Dividing the skin, platysma, and fascia; any veins in the way and the tendon of the digastric may be drawn upwards, and the artery sought, above the cornu and below the nerve. Care must be taken not to penetrate the pharynx—superior constrictor, on which the vessel here rests; and such caution is especially necessary, as the thin pharyngeal bag rises and subsides under the knife. Application of the ligature presents no special difficulty.

LIGATURE OF THE SUBCLAVIAN.—*Surgical Anatomy.*—The right and left subclavian arteries differ only in part of their course; that portion of the latter vessel which extends from the arch of the aorta to the inner margin of the first rib at the root of the neck, or the *thoracic* portion of the left subclavian. But this part of the left subclavian artery is never selected for ligature.

The subclavian on the *right* side extends from behind the *sterno-clavicular* articulation, and the *cervical* portion of the *left* subclavian from the *first rib*, outwards to the *lower margin* of the first rib; *arching*, in its course, over the apex of the lung and pleura, and passing between the scaleni muscles.

Either artery, in this course, may be divided into *three portions*, for the convenience of description, surgically as well as anatomically. The *first* portion, extends from the sterno-clavicular articulation—or first rib, on the left side—to the inner border of the anterior scalenus; the *second* portion, beneath the scalenus; and the *third*, from the outer border of that muscle to the lower margin of the first rib. The anterior scalenus muscle is thus the boundary between the inner and outer portions of the subclavian artery, and of the middle portion beneath that muscle.



(1) *Internal* to the anterior scalenus, the artery ascends slightly outwards, and is deeply placed. *Covered* by the skin, platysma, and fascia, it is also concealed by the clavicular origin of the sterno-mastoid and by the sterno-hyoid and sterno-thyroid muscles. Deeper still, and immediately in front of the artery crossing it from above downwards, are the pneumogastric nerve and the internal jugular vein; the latter having inclined outwards from the common carotid in the lower part of the neck, leaves a triangular interval between these two vessels. Along the base of this interval lies the subclavian artery; the pneumogastric descends vertically over it, and sends off its recurrent laryngeal branch, which hooks up behind the vessel. *Posteriorly*, the artery is opposite to the transverse processes of the vertebræ, and longus colli muscle, but separated by a cellular interval; in which the trunk of the sympathetic and recurrent laryngeal nerve are in more immediate relation, the latter having hooked round the artery. *Inferiorly*, the artery lies on the pleura; and lower down, the corresponding portion of the subclavian vein runs transversely inwards to join the internal jugular, in forming the innominate vein, behind the sterno-clavicular articulation.

Three *branches* arise from the subclavian, in this part of its course; the vertebral, ascending to the head through the foramina in the transverse processes of the cervical vertebræ; the internal mammary, descending to the chest; and the thyroid axis, a short thick trunk arising from the front of the artery, and dividing into the inferior thyroid, the supra-scapular, and transverse cervical branches.

The first part of the *left* subclavian is more vertical, the internal jugular and pneumogastric incline inwards over the common carotid, the recurrent branch is given off round the arch of the aorta; and thus the artery may be somewhat more free than on the right side.

(2) *Beneath* the scalenus, the subclavian reaches its highest point above the clavicle, is transverse and curved in direction, and placed less deeply than in the first part of its course. *Covered* by the skin, platysma, and fascia, it has also in front of it, the clavicular origin of the sterno-mastoid, and the anterior scalenus muscles; the latter being attached by a flat narrow tendon to the inner border and upper surface of the first rib. Between the two muscles, the phrenic nerve descends obliquely inwards, lying on the scalenus. *Posteriorly*, the artery rests on the posterior scalenus muscle; thus passing between the scaleni. *Above* the artery, in this interval, are the large trunks of the lower cervical nerves which form the brachial plexus. *Below*, the artery curves over the apex of the lung and pleura. The subclavian vein runs transversely inwards, below the level of the artery; the anterior scalenus muscle intervening between the two vessels.

One *branch* only arises from this part of the subclavian; namely, the superior intercostal artery from its posterior aspect, which turns downwards over the neck of the first rib to supply the first two intercostal spaces. On the left side, this branch springs, commonly, from the first portion of the subclavian; thus making four, or all the branches of this artery, to arise from that part of the vessel.

(3) *Beyond* the scalenus, the subclavian descends to the *lower margin* of the first rib, and is more superficial than in either of the previous portions of its course. It is situated in the lower or clavicular part of the posterior triangular space of the side of the neck; behind and partly below the middle third of the clavicle. But the depth of the artery

below this bone will vary with the elevation of the shoulder, whereby it may sink altogether below that level.

It lies in a small triangular space : bounded, internally by the outer border of the sterno-mastoid concealing the anterior scalenus ; superiorly, by the omo-hyoid muscle passing slantingly upwards and inwards to the sterno-mastoid and then beneath it ; and inferiorly, by the clavicle. This small space is commonly not more than one inch and a half in extent, from the sterno-mastoid outwards, and about the same from above downwards along that muscle. But these dimensions will vary with the length of the clavicular origin of the sterno-mastoid, and the clavicular attachment of the trapezius. Usually attached, respectively, to the inner and outer third of the clavicle ; the muscles in some persons may nearly meet along the whole length of this bone. Then again, the height to which the omo-hyoid rises about the clavicle considerably affects the vertical length of the space. Its *depth* varies naturally with the thickness of the neck, and is altered by the position of the shoulder.

This portion of the subclavian is *covered* only by the skin, platysma, and fascia, with some of the superficial descending branches of the cervical plexus ; but below, the artery is under cover of the clavicle and crossed, beneath this bone, by the supra-scapular branch from the thyroid axis. The transverse-cervical branch traverses the upper angle, at the junction of the omo-hyoid and sterno-mastoid muscles. Here also, the external jugular vein coming downwards over the last-named muscle, enters the space to open into the subclavian vein. The artery *rests* on the pleura and upper surface of the first rib ; on which, between the vessel and the tendon of the scalenus, a *tubercle* may be felt—the guide to the artery. *Above*, is the brachial plexus, consisting of three nervous cords, supported by the posterior scalenus muscle ; *below*, lies the subclavian vein.

No branch arises from this, the third portion of the artery.

*Operation.*—*Internal to the scalenus.*—A transverse incision over the clavicular origin of the sterno-mastoid, leads down to the vessel in this part of its course. (Fig. 69, c.) But a vertical incision also along the inner border of the muscle may be added, if necessary, for space ; and the V-shaped flap of integument raised, with the platysma and fascia. The clavicular portion of the muscle and the sterno-hyoid and sterno-thyroid muscles beneath, are then to be divided transversely, just above the clavicle, and the vessel exposed. The internal jugular vein may be drawn outwards and guarded with a spatula, and the pneumogastric nerve being avoided, the aneurism-needle armed with a ligature should be passed around the artery from below upwards.

*Beneath the scalenus.*—A V-shaped incision should be made, but with the angle looking inwards. Thus, a transverse incision over the clavicular origin of the sterno-mastoid, from two to three inches in length, is met by a vertical incision about two inches long, rather external to the outer border of the sterno-mastoid ; and the flap of skin, platysma, and fascia, is raised upwards and inwards. The external jugular vein may be conveniently drawn outwards. The clavicular portion of the sterno-mastoid must then be divided inwards as far as may be necessary to expose the anterior scalenus clearly. The phrenic nerve lying on that muscle, and the internal jugular vein along its inner border, are to be drawn inwards, and guarded with a spatula. Partially dividing the muscle with caution, from without inwards, the artery comes into view. The aneurism-needle should be passed from below upwards.

*Beyond the scalenus.*—The shoulder being depressed as low as possible, and the skin of the neck drawn down over the clavicle, a transverse incision is made along the clavicle, extending from the border of the sterno-mastoid outwards to the trapezius muscle, and in depth down to the bone. (Fig. 68.) The skin, platysma, and fascia are thus divided. On allowing the integuments to resume their place, the incision will rise to just above and parallel to the clavicle. If there be reason, as already explained, to suppose that the artery lies deeply, a vertical incision may be added, as in Fig., or along the outer border of the sterno-mastoid muscle, and meeting the transverse one below at a right angle. The sterno-mastoid or trapezius, approaching each other along the clavicle in some cases, either or both these muscles may be here divided sufficiently to reach the artery on the first rib. The external jugular vein should be drawn inwards, and the deep cervical fascia cautiously divided to expose the artery. The supra-scapular artery running outwards nearly under the

Fig. 68.



clavicle, must be drawn down, and the omo-hyoid muscle upwards and outwards, thus also guarding the transverse cervical artery at about the junction of the omo-hyoid and sterno-mastoid muscles—the upper angle of the triangular space in which the subclavian lies. This vessel, fawn-coloured, will now be fairly seen; with the three white cords of the brachial plexus above, and the large, turgid, blue subclavian vein below. On passing the finger down the anterior scalenus, the *tubercle* on the upper surface of the rib can be felt, and thus the situation of the artery, ascertained; lying, as it does, on the outer side of the tubercle. Avoiding the sub-

clavian vein, the aneurism-needle should be insinuated between it and the artery, but care must also be taken not to include the lowest of the three nervous cords, as the point of the needle emerges on the opposite side. The depth and narrowness of the space, in some cases, may render this proceeding perplexing, and considerable difficulty may be experienced in fixing the ligature, it being perhaps impossible to reach the vessel with both forefingers. As a substitute, Liston recommended a *serre naud* to be used—a strong wire, perforated or notched at one end. One only, or two, may be employed, or a double one, according to the judgment of the Surgeon. Of course, the effect on the pulsation below should be ascertained before tightening the ligature. A suture or two having been inserted to bring the edges of the wound together, the limb must be elevated and wrapped in cotton wool to maintain the circulation, as after the ligature of any other main artery.

**LIGATURE OF THE AXILLARY ARTERY.**—*Surgical Anatomy.*—This vessel—the continuation of the subclavian—extends from the *lower border* of the first rib, through the axilla, to the *lower border* of the conjoined



tendon of the latissimus dorsi and teres major muscles, at its insertion into the inner edge of the bicipital groove of the humerus. *Curved* in its direction, the convexity of the curve looks upwards as the arm lies by the side of the body; but the artery becomes straight when the limb is raised to a right angle with the chest.

The axillary artery may be divided, for the convenience of description, into *three parts*; the *first* above, the *second* beneath, and the *third* below, the small pectoral muscle. The two first portions are more deeply placed than the third portion of this vessel, which becomes superficial below the great pectoral muscle.

*Posteriorly*, the artery lies *above*, on the first intercostal space and first digitation of the serratus magnus muscle, also the nerve to that muscle—the posterior thoracic or external respiratory of Bell—which entering the apex of the axilla from the posterior scalenus, crosses underneath the artery. *Beneath* the small pectoral, the artery is opposite to, but not in contact with, the upper portion of the subscapularis muscle; *below* that boundary, the vessel lies on the lower part of the subscapularis, and then on the tendons of the latissimus and teres major muscles. *Anteriorly*, the artery is covered throughout its course by the skin and fascia; and above, by the clavicular portion of the great pectoral muscle, under which is a prolongation from the costo-coracoid membrane to the sheath of the vessels. The cephalic vein, lying in the interval between the deltoid and great pectoral muscles in front of the shoulder, sinks near the clavicle under the latter muscle, and crosses the axillary artery to open into the axillary vein. It thus penetrates the costo-coracoid membrane, which is also perforated by the acromial thoracic artery—a short trunk from the front of the axillary, and by the outer of the two anterior thoracic nerves—a small branch from the outer cord of the plexus, and which crosses inwards over the axillary artery to enter the under surface of the great pectoral muscle. The inner anterior thoracic nerve—a small branch from the inner cord—turns upwards between the artery and vein to enter the under surface of the small pectoral muscle.

Beneath the small pectoral, the artery is covered by that muscle and the superimposed part of the pectoralis major. The portion of artery below the small pectoral is overlaid by the lower border of the great pectoral, and then only by the skin and fascia, superficial and deep. On the outer side, the coraco-brachialis muscle lies along this portion of the artery, thus completing its muscular relations.

Enclosed in a common *sheath* with the artery are—the axillary vein to its inner side, and the two cords of the brachial plexus, lying to the outer side of the artery *above* the small pectoral. *Beneath* that muscle they assume a new arrangement. The lowest, or inner nervous cord, passes to the inner side of the artery, separating it from the vein; and either cord furnishes a fasciculus, which uniting, form a third cord *behind* the vessel. Near the lower border of the small pectoral, a fasciculus from either primitive cord, *outer* and *inner*, form the median nerve which passes to the outer side of the artery, the fasciculus from the inner cord having crossed *over* the vessel to join that from the outer cord. Thus the artery is surrounded with nerves in this the second portion of its course, or beneath the small pectoral muscle. Below this muscle, the vessel is even more entirely surrounded with nerves. On the outer side lie the external cutaneous as well as the larger-sized median nerve, both derived from the outer cord; on the inner side, between the artery and

vein are the ulnar, internal cutaneous, and nerve of Wrisberg, all derived from the inner cord; and behind the artery are the musculo-spiral and circumflex nerves, both derived from the posterior cord. Three subscapular nerves are also derived from the posterior cord, but these muscular branches have no immediate relation to the artery.

Six *branches* are given off by the axillary artery—the superior thoracic, opposite the first intercostal space; the acromial thoracic to the pectoral and deltoid muscles; the alar thoracic, an inconstant branch to the axillary glands; the long thoracic under the lower border of the great pectoral muscle to about the sixth intercostal space; the subscapular branch along the lower border of the muscle so named; and the circumflex branches anterior and posterior, the latter being the larger, encircling the neck of the humerus.

*Operation.*—Above the small pectoral muscle.—An incision is made just under the clavicle, extending from near its sternal end to the interval

FIG. 69.



between the pectoral and deltoid muscles, on the inner side of the acromion. (Fig. 69, *a*.) The pectoral muscle is next divided to this extent, and the costo-coracoid sheath cautiously opened; then the cephalic vein being drawn to the outer side, thus also protecting the cords of the brachial plexus more deeply placed, the axillary vein is drawn towards the chest, and the ligature-needle passed under the artery from within outwards. If the trunk of the acromial thoracic artery be wounded, it will bleed almost as profusely as an aperture in the axillary trunk; and the

inclusion of either anterior thoracic nerve should be avoided in passing the ligature.

*Beneath* the small pectoral muscle, the artery should not be selected for operation, owing to its greater depth in that part of its course, and more intimate relation to the cords of the brachial plexus.

*Below* the small pectoral, the artery is most superficial and accessible, particularly beyond the great pectoral muscle. Abducting the arm and bending the forearm, will bring the vessel even more to the surface, and also relax the nervous cords surrounding it. An incision about three inches long may be made from the lower border of the great pectoral muscle, downwards over the course of the artery, along the border of the coraco-brachialis muscle; and the skin and fascia divided. The deep or aponeurotic fascia must then be divided. By drawing the median nerve to the outside, and the vein to the inside of the wound, the artery can readily be discovered, and separated so as to pass the ligature-needle without including either of the adjoining nerves which lie around the vessel.

*LIGATURE OF THE BRACHIAL ARTERY.*—*Surgical Anatomy.*—In continuation of the axillary, the brachial artery commences at the *lower border* of the tendon of the latissimus and teres major muscles, and

terminates just below the bend of the elbow, opposite the *neck* of the radius; where it divides into the *radial* and *ulnar* branches. In *direction*, this artery winds round the humerus, from above at its internal aspect, to below in front of that bone and the elbow-joint. Throughout its extent, the vessel is superficial; except at the elbow, where it sinks into the flexure of the joint.

*Covered* throughout its course, by the skin, superficial and deep fascia; at the elbow, the brachial artery is also overlaid by a prolongation from the tendon of the biceps muscle, and by the median basilic vein horizontally crossing the line of the artery. *Behind*, from above downwards, it has the following relations. As the vessel lies inside the humerus, it rests on the long head of the triceps muscle and then on its inner head; inclining to the front, it rests on the insertion of the coraco-brachialis and then on the brachialis anticus muscle, to the bend of the elbow. Thus the artery is supported by muscles throughout its course. At the *outer* side, the brachial corresponds; above, to the coraco-brachialis, overlaid by the biceps, to about the middle of the arm, or opposite the insertion of the deltoid externally; and in the remainder of its extent, to the biceps only, as the vessel lies on the brachialis anticus. In the bend of the elbow, the tendon of the biceps passes down, on the outer side of the vessel. In immediate relation, are two *venæ comites*, one on either side of the artery, and which encircle it with communicating branches; these veins taking the place of the single large axillary vein above, on the inner side of the axillary artery. A superficial vein—the basilic—overlies the brachial, separated by the deep aponeurotic fascia, to about the insertion of the coraco-brachialis, or the middle of the arm; there penetrating the fascia, this vein becomes continuous with the axillary.

Certain nerves grouped around the axillary artery, in its course beyond the small pectoral muscle, still remain in immediate relation with the brachial, and are thus disposed of. The median nerve, lying to the outer side as low as the insertion of the coraco-brachialis muscle, then descends over, or under, the artery, to gain its inner side about two inches above the elbow; and in the bend of the joint, it is placed on the inner side, about half an inch apart, as the vessel inclines outwards to the neck of the radius. This nerve is, otherwise, in contact with the artery throughout its course. The ulnar nerve continues close to the inner side of the brachial artery as low as the insertion of the coraco-brachialis; but there inclining inwards, it passes through the inner intermuscular septum, and imbedded in the triceps muscle, reaches the interval between the olecranon and inner condyle, thus losing all relation to the artery. The internal cutaneous, also to the inner side at first, it then lies over and on the artery as far as about the middle of the arm; there, perforating the deep fascia, it loses this intimate relation; its anterior branch, with the basilic vein, still, however, overlaying the artery. The musculo-spiral nerve remains posterior for about two inches only; then passing backwards and outwards between the inner and outer heads of the triceps, it winds round the humerus and ceases to have any relation to the artery.

Three named *branches* are given off from the inner side of the brachial; the superior profunda, arising near the lower border of the teres major tendon, winds backwards and accompanies the musculo-spiral nerve; the inferior profunda passes off opposite the insertion of the coraco-brachialis, with the ulnar nerve to the interval between the olecranon and inner condyle; and the anastomotic, which arises an inch or two above the elbow, and has the same destination.

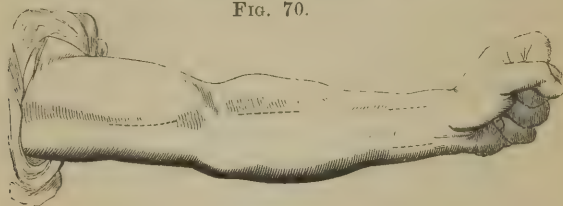


*Operation.*—The brachial artery may be ligatured in either part of its course.

In the *first* portion, or that which corresponds to the *coraco-brachialis* muscle, the artery is reached as in the third portion of the axillary, and the brachial being less encompassed with nerves, it is more accessible. An incision along the border of the muscle, and dividing the skin, and fascia, leads down to the vessel. The deep or aponeurotic fascia is then divided, and on drawing the median nerve to the outer side, the artery, with its *venæ comites*, is exposed, with the internal cutaneous nerve to the inner side or in front of the vessel. Separating this nerve, the aneurism-needle may be passed round the artery from either side most convenient to the operator, avoiding, perhaps, the *venæ comites*. But I have frequently included one or both such veins in ligaturing a second-sized artery, and without any evil consequence.

The *second* portion of the brachial—that in relation to the *biceps*—is ligatured in a similar manner. An incision, from two to three inches long is made on the inner border of this muscle (Fig. 70), avoiding the basilic vein; having reached the artery, the median nerve, crossing it obliquely

FIG. 70.



or at the inner side, may be drawn to that side, with the vein. The artery, with its *venæ comites*, will thus be exposed, and the needle readily passed.

The *third* portion of the brachial—that in the *bend of the elbow*—requires ligature only for wound of the artery in this situation. The external wound will guide to the aperture in, or the division of, the vessel; itself lying on the inner side of the *biceps* tendon with the median nerve more internal, by about half an inch.

Aneurismal varix and varicose aneurism at the bend of the elbow, owing to communication of the brachial artery and median basilic vein, are conditions both analogous as to the operation for ligature *in situ*; but they present certain difficulties not met with when the artery alone is wounded. These complications have already been noticed—ANEURISMAL VARIX.

**LIGATURE OF THE RADIAL ARTERY.**—*Surgical Anatomy.*—The radial artery extends from the *bifurcation* of the brachial, opposite the *neck* of the *radius*, to the *end* of this bone; and thence posteriorly through the first interosseous space to the *palm* of the hand. It is thus found in the forearm, the back of the wrist, and palm. In *direction*, the continuation of the brachial, a line drawn from the centre of the bend of the elbow to the styloid process of the radius, will indicate the course of the radial in the forearm. More deeply placed above, between muscles; it becomes quite superficial below as it approaches the wrist.

At first on the inner side of the radius, it soon lies over that bone,

*resting* on the following muscles, in order, from above downwards; supinator brevis, tendon of pronator radii teres, radial origin of flexor sublimis, flexor longus pollicis, pronator quadratus; and on the end of the radius, above the wrist. In the *upper half* of this course, the artery runs *between* the fleshy bellies of the supinator longus externally, and the pronator teres internally, being slightly overlaid by the former muscle; in the *lower half*, it is *between* the tendons of the supinator longus and flexor carpi radialis. The *radial nerve*—a terminal branch of the musculo-spiral in front of the external condyle of the humerus—passes down under cover of the supinator to the outer side of, but not in contact with, the artery as far as the insertion of the pronator teres; then lying by the side of the vessel, the nerve passes backwards under the tendon of the supinator and becomes cutaneous, thus losing any immediate relation to the vessel. Throughout its course in the forearm, the artery is *covered* only by the skin, superficial fascia, and the deep or aponeurotic fascia.

The named *branches* are three. The radial recurrent, a branch of some size, is given off transversely under cover of the supinator longus muscle; it supplies the muscles on the outer side of the forearm, and sends an offset upwards to anastomose with the superior profunda branch of the brachial artery. The superficial volar, and the anterior carpal branches, arise just above the wrist.

Neither of these branches is important in the operation of applying a ligature to the radial trunk, except the first.

*Operation*.—In the *upper* or deeper part—an incision (see Fig. 70) along the inner or ulnar margin of the supinator longus, and through the deep fascia, will lead down to the artery, which is somewhat overlaid by that muscle; its fibres being distinguished by their vertical direction from those of the pronator teres, obliquely crossing the line of incision. Drawing the supinator and with it the radial nerve, outwards; the artery is seen with its *venæ comites*, one of which commonly lies in front. In passing the needle, it is unimportant whether it be included and ligatured.

*Lower down* and superficial towards the wrist; an incision on the outer or radial side of the flexor carpi radialis tendon (see Fig. 70) leads to the vessel, under the deep fascia; lying about midway between this tendon and that of the supinator longus. The radial nerve is here quite out of the way, and the *venæ comites* are unimportant.

On the *back* of the *wrist*, and in the *palm*, the radial is tied only for wound, and at the wounded point. In the former situation, as the artery passes from the end of the radius to the apex of the first interosseous space, it is crossed by the tendons of the three extensors of the thumb, successively; the extensor ossis metacarpi pollicis, and the extensors, primi and secundi internodii pollicis. Either of these tendons may guide to the wounded artery.

LIGATURE OF THE ULNAR ARTERY.—*Surgical Anatomy*.—The ulnar artery extends from the *bifurcation* of the brachial, opposite the *neck* of the *radius*, to the *end* of the *ulna*; thence into the *palm*, to join with the radial in forming the palmar arches, superficial and deep. In direction, it arches from its commencement, inwards towards the ulna, and then downwards; thus not appearing to be the continuation of the brachial, although the ulnar is of larger size than the radial branch. More deeply placed above between muscles, it becomes quite superficial below as it approaches the wrist. At first, it *rests* on the insertion of the brachialis anticus into the coronoid process of the ulna; curving inwards and down-

wards, it lies on the flexor profundus. In the *upper half* of this course, the artery passes *between* the flexor profundus and four, of the five, muscles arising from the inner condyle of the humerus, which overlay and cross the vessel in their direction from within outwards; namely, the pronator radii teres, flexor carpi radialis, palmaris longus, and beneath these three, the flexor digitorum sublimis. Then passing *between* the flexor carpi ulnaris and digitorum sublimis, and overlaid by the former muscle; in its *lower half*, the artery is *between* the tendons of the flexor ulnaris and sublimis, the former tendon somewhat overlaying it. The *ulnar nerve*, entering the forearm between the attachments of the flexor ulnaris to the inner condyle and olecranon, approaches the artery under cover of that muscle, and from about the middle of the forearm, continues down on the inner side of the vessel to the wrist; the nerve being even more concealed by the flexor ulnaris tendon. A small branch of this nerve descends in front of the lower part of the artery, to the skin of the palm; both artery and nerve passing over the annular ligament to the hand.

The *median nerve*, to the inner side of the vessel at its commencement, crosses over to the outer side, and loses all relation to the artery. Throughout its course, the ulnar artery is *covered* by the skin, superficial and deep fascia, as well as by the superficial layer of muscles, above; below, only by the integuments.

The named *branches* of this artery are five; anterior ulnar recurrent, and posterior ulnar recurrent, both arising close to the elbow-joint and passing upwards to complete the anastomosis around the joint; the interosseous trunk, the largest branch given off, passes backwards to the interosseous membrane, there dividing into anterior and posterior branches, metacarpal branch, arising near the wrist; and carpal branches, anterior and posterior, anastomosing with corresponding offsets of the radial, across the front and back of the wrist. Neither of these branches is important in the operation of applying a ligature to the ulnar trunk, except the third or interosseous.

*Operation.*—In the *upper* or deeper part, an incision along the radial border of the flexor carpi ulnaris will lead down to the vessel as it lies between this muscle and the flexor digitorum sublimis; the fibres of the former muscle being distinguished by their more vertical direction from those of the sublimis, obliquely crossing the line of incision. Separating these muscles, the ulnar nerve will probably be out of the way, internally; the artery is seen and the ligature passed. More difficulty, however, may be experienced in a muscular arm, than with the corresponding portion of the radial artery.

*Lower down* and superficial towards the wrist, an incision (see Fig. 70) along the radial side of the flexor carpi ulnaris tendon leads to the vessel, under the deep fascia, and perhaps somewhat overlaid by the tendon. The ulnar nerve, more under cover, is drawn inwards, and the ligature passed between it and the artery.

On the *annular ligament* of the wrist, and in the *palm*, the operation is performed only for Wound, and at the wounded point.

LIGATURE OF THE ABDOMINAL AORTA; AND OF THE ILIAC ARTERIES, COMMON, EXTERNAL AND INTERNAL.—*Surgical Anatomy.*—The abdominal aorta, lying on the bodies of the lumbar vertebræ, inclines downwards to the left, and divides opposite the left side of the *fourth* lumbar vertebra, into two *common iliac* arteries, a right and a left. Either common iliac extends from the *bifurcation* of the aorta at this point, to opposite the



intervertebral cartilage between the fifth or last lumbar vertebra and *base* of the *sacrum*—about two inches in length. It there divides into two trunks or branches, *external* and *internal* iliacs: the external extending from this point, along the *psaos* muscle internally, to the lower border of *Poupart's ligament*; the internal extending from the same point, downwards and outwards on the *pyriform* muscle, to the *sacro-sciatic foramen*, about one inch and a half only in length, and smaller in size than the external iliac.

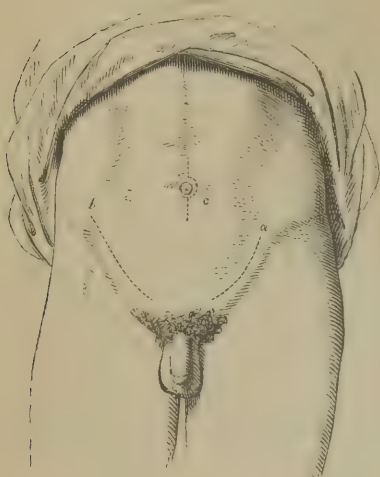
The relation of the companion veins of these arteries is primarily important in their Surgical Anatomy. For the convenience of description the companion veins may be taken from above downwards.

The *vena cava inferior* lying on the vertebral column to the right of the abdominal aorta, is situated also to the outer side of the right common iliac artery at its commencement; dividing into two *common iliac* veins, the *right* continues on the outer side of the corresponding common iliac artery, and then passes beneath it, the left common iliac vein also passing beneath that artery above. Thus, the right common iliac artery lies on both these veins. The *left* common iliac vein, emerging from beneath the right artery, near the bifurcation of the aorta into both common iliacs, proceeds to the right or inner side of the left common iliac artery. The common iliac veins dividing at, or near, the bifurcation of the common iliac arteries; the *right external iliac* vein passes beneath the right external iliac artery to its left or inner side, where it is found at *Poupart's ligament*; the *left external iliac* vein lies entirely on the right or inner side of the left external iliac artery; and *both* the *internal iliac* veins are posterior to the corresponding internal iliac arteries, the right being somewhat external to its artery. The *muscles* in relation to these arteries are:—the *psaos*, on the outer side of the common iliac, at its termination; and then along the outer side of the external iliac to its termination, where the artery lies on the muscle at *Poupart's ligament*; this muscle is also near the internal iliac at its commencement, the external iliac intervening, while the *pyriform* muscle is behind this artery, on which it rests and on the lumbo-sacral nerve. In *front*, the *peritoneum* overspreads these three arteries, the internal iliac being contained in the fold that forms the posterior ligament of the bladder. Branches of the *sympathetic nerve*, proceeding from the aortic plexus in front of the lower part of the aorta, descend over the common iliacs to the hypogastric plexus in the upper part of the concavity of the sacrum. The *inferior mesenteric* artery crosses the left common iliac. The *ureter* crosses, sometimes the common iliac of its side, but generally the external and internal iliacs, the former at its commencement, the latter lower down. The *external iliac*, near *Poupart's ligament*, is overlaid by the *spermatic vessels* and genital branch of the *genito-crural nerve*, proceeding obliquely inwards to the internal abdominal ring; it is crossed outwards by the *circumflex iliac vein*, and inwards, just above the ligament, by the *vas deferens* turning down on the inner side of the artery. The *abdominal parietes* are interposed between the aorta and iliac arteries and any operation on these vessels. They consist of the skin and superficial fascia; the tendon of the external oblique muscle, the internal oblique and transversalis muscles; the transversalis fascia, and peritoneum, which are loosely connected about the situation of the internal abdominal ring, where the spermatic cord passes through the abdominal walls.

*Operation*.—The iliac arteries, external, internal, and common, and even the aorta, may be reached by the same line of incision; commencing

a little above the middle of Poupart's ligament—where the cord passes through, and carried outwards and upwards, nearly parallel with the

FIG. 71.\*

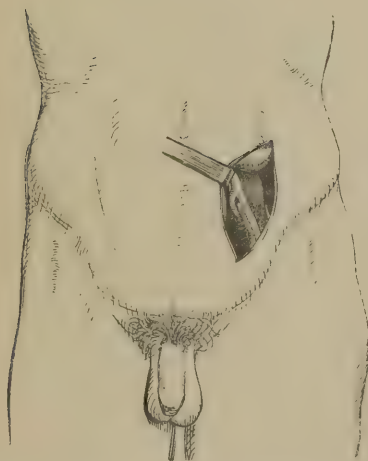


ligament, to about the anterior superior spine of the ilium, or as far higher as may be necessary (Fig. 71).

(1) To reach the *external iliac*, this incision may terminate near the anterior superior spine. The skin and superficial fascia only are first divided. The bluish-white tendon of the external oblique is next carefully divided to the same extent; exposing the spermatic cord as it passes under the lower margin of the internal oblique and transversalis muscles, in the lower angle of the incision. These muscles should now be divided with great caution, and the dull white transversalis fascia recognised beneath. Raising this fascia with the forceps, at its thinnest and loosest part, near where the cord passes, an aperture is

made, using the knife laterally; the finger should then be gently introduced between the fascia and peritoneum, and the former divided to the full extent of the external wound.

FIG. 72.



The peritoneum, thus exposed, can then be detached with the fingers from its loose cellular connexion in the iliac fossa, and drawn to the middle line, without damaging this membrane. Spatulæ are of use in retaining it there, or the fingers of an assistant may be preferable (Fig. 72). The fawn-coloured artery is seen on the inner border of the psoas muscle, crossed generally by the white tape-like ureter above; unless the peritoneum be raised to a higher point, when the ureter adhering to that membrane, will be raised with it. Lower down the artery is crossed obliquely inwards by the spermatic vessels, and genital branch of the genito-crural nerve. Between these two points,

the aneurism-needle can be passed most readily, with the usual precaution of introducing it between the artery and vein, here below.

\* Letter *a* marks the line of incision for the lower part of the external iliac; *b* shows that for the upper part of this vessel, for the internal, or for the common, iliac arteries.

(2) The *internal iliac* is reached by the same incision, carried a little further upwards and inwards. This artery also is crossed by the ureter, which may be raised with the peritoneum; the companion vein is somewhat posterior, and the external iliac vein outside, at the commencement of the vessel.

(3) The *common iliac* can be reached by prolonging the incision upwards, and curving it inwards, to the extent of six inches; and there is always an advantage in having the incision below near the middle of Poupart's ligament—the loose connexion of the transversalis fascia with the peritoneum, in that situation, facilitating the detachment of the latter membrane and raising it from the artery, which is the most critical part of the operation. The common iliac artery will be found by tracing up the external iliac along the border of the *psoas* muscle. But high up the trunk ceases to have this immediate relation to the muscle, and is most intimately related to venous trunks; on the right side, the companion common iliac vein lying externally, and both it and the left common vein passing behind the artery; while on the left side, the vein lies immediately internal to the artery. Their dark blue colour and large size, contrast with the smaller, fawn-coloured artery. The ureter, like a white band, may perhaps cross the artery on either side; and the inferior mesenteric artery is always in front, on the left side; but generally both it and the ureter are out of the way.

(4) The *abdominal aorta* may be reached in the middle line, as by the operation devised and performed by Sir A. Cooper. Taking the precaution of having the bowels well emptied, an incision was made through the *linea alba*, three inches in length, its centre corresponding to the umbilicus (see Fig. 71, c); the peritoneum was then opened to about the same extent, the intestines, having been emptied, did not protrude. Passing the finger down between their convolutions on to the spine, the aorta was felt beating strongly. The peritoneum was scratched through with the finger-nail, and the finger being insinuated under the aorta, an aneurism-needle was conveyed round it, and the ligature tied.

**LIGATURE OF THE FEMORAL ARTERY, COMMON AND SUPERFICIAL.—**  
*Surgical Anatomy.*—The femoral artery, a continuation of the external iliac, extends from the lower border of *Poupart's ligament* to the aperture in the *adductor magnus* muscle, at the junction of the middle and lower third of the femur, internally. In the upper third of the thigh, the artery lies somewhat internal to the head of the femur; in the middle third, the remaining portion of the vessel inclines to the inner side of the shaft of the femur. In point of *depth* also, the first part is superficial and uncovered by muscle; the second part is deep and covered by muscle—the *sartorius*.

In the *upper third* of the thigh, the femoral artery is contained in Scarpa's triangular space. This space is bounded above by Poupart's ligament, forming the base; and laterally by the *sartorius* muscle on the outer side, and the *adductor longus* on the inner, meeting below in the apex. The artery passes down through the middle of this space, from mid-base to apex. But the length of the space, and consequently of this portion of the femoral, varies with the height at which the *sartorius* muscle inclines inwards and the breadth of that muscle. The artery *lies* on the *psoas* muscle, slightly tilted to its inner side under Poupart's ligament, then over the *pectineus* muscle separated by the profunda artery and vein in cellular tissue, and then on the femoral or companion vein, which



intervenes between the femoral artery and adductor longus muscle at the apex of the space.

Entering Hunter's canal, the artery—in this the *middle third* of the thigh—*lies* on the adductor longus, and lastly, on the adductor magnus, to the aperture of exit in that muscle. The artery is thus slung as it were, close to the femur, on the insertions of these two muscles into the *linea aspera*; and it is bounded externally by the vastus internus muscle, wrapping round the inner surface of the femur to the *linea aspera*.

*Covered* in the *upper third* of the thigh.—Scarpa's triangle, only by the skin and superficial fascia, the deep fascia or fascia lata, and by the inguinal glands; in the *middle third*, corresponding to Hunter's canal, the artery is also covered by the sartorius muscle, lying vertically over its course, and by an aponeurotic covering under this muscle, stretching across between the vastus internus and the tendons of the two aforesaid adductor muscles—thus completing the *canal* through which the artery passes.

The femoral artery and vein, the latter lying to the inner side under Poupart's ligament, are enclosed in a loose tubular sheath, formed by a prolongation in front from the transversalis fascia of the abdominal wall, and behind, from the fascia iliaca; narrowing downwards around the femoral vessels, to about two inches in extent below the ligament, this sheath becomes continuous with the common *cellular sheath* which also invests the vessels *within* the special or *crural sheath*. The outer border of this sheath is straight, the inner oblique; and, from about half an inch below Poupart's ligament, the inner border corresponds to the *saphenous opening* in the fascia lata, itself about one inch and a half in length. The curved *falciform process* of Burns—bounding the outer margin of this opening—is that portion of the iliac part of the fascia lata which overlays the sheath of the femoral vessels; and the *upper corner* of this process stretches inwards to join the base of *Gimbernat's ligament*—thus giving the outer margin of the saphenous opening a direction downwards and inwards. Behind the sheath of the femoral vessels, the pubic or inner portion of the fascia lata passes outwards over the pectineus muscle.

Enclosed within the sheath, the *femoral vessels* are separated by a cellular septum; and another septum to the inner side of the vein, forms a third or inner compartment—the *crural canal*, which is unoccupied otherwise than by a lymphatic gland, excepting when a femoral hernia descends through it to the saphenous opening. The *crural branch* of the genito-crural nerve perforates the outer side of the sheath in *front* of the artery, and then pierces the fascia lata near Poupart's ligament to become subcutaneous. A small *branch* from the anterior crural nerve, above Poupart's ligament, descends *on* the artery. The long, internal, *saphena vein* on the inner aspect of the thigh, enters the saphenous opening to join the femoral vein; and some superficial *lymphatic vessels* also enter this opening to pass through the crural canal to the abdomen.

Continuing the course of the femoral vessels downwards in the thigh, *below* the sheath; the vein still lies to the inner side of the artery, but winding behind it is then found on the outer side, at the upper border of the adductor longus; passing out of Scarpa's triangle, and with the artery entering Hunter's canal, the vein is still to the outer side, and it so passes through the opening in the adductor magnus.

The *anterior crural nerve*, under Poupart's ligament, lies on the outer side of the femoral vessels, but not enclosed in their sheath; being about

half an inch distant, and separated by the tendon of the psoas muscle, on the inner side of which is the artery. The nerve lying in the groove between that muscle and the iliacus externally, it appears as a large, white, flat band, which soon divides into a superficial or cutaneous and a deep or muscular part.

The *superficial* part gives off the middle, and internal, cutaneous nerves of the thigh, and the internal saphenous nerve. The middle cutaneous pierces the fascia about three inches below Poupart's ligament, and dividing into two cutaneous branches which descend on the front of the thigh, it thus loses all relation to the artery. The internal cutaneous inclines obliquely inwards over the femoral artery, and divides into two branches; the anterior, descending on the sartorius muscle to the middle of the thigh, and there piercing the fascia lata; the internal, descending along the inner border of that muscle to pierce the fascia on the inner side of the knee. The internal or *long saphenous* nerve—the largest of the three superficial branches—descends on the outer side of the femoral artery; entering Hunter's canal under the vertical portion of the sartorius, it lies with the femoral vein still to the outer side of the artery, but somewhat posterior to the vein, and external to the cellular sheath containing it and the artery. At the opening in the adductor magnus, the saphenous nerve leaves the femoral vessels on their becoming popliteal; it is continued beneath the sartorius muscle to the inner side of the knee, there to pierce the fascia between the tendons of the sartorius and gracilis muscles. About the middle of the thigh, a communicating branch crosses inwards beneath the sartorius to join an offset of the internal branch of the internal cutaneous, and another from the anterior division of the obturator comes down in front of the adductor brevis to the lower border of the adductor longus. These three offsets here form a sort of *plexus*, beneath the fascia lata.

The *deep* or *muscular* part of the anterior crural nerve divides into a brush of branches, which have more or less relation to the artery externally, towards the apex of Scarpa's triangle. Disappearing under the sartorius to enter the muscles; they supply that muscle, the rectus femoris, the vastus externus, and vastus internus—the branch to this muscle descending near the internal saphenous nerve, which it nearly equals in size; a small branch or two also crosses inwards behind the femoral vessels to the pectineus muscle.

*Branches of the Femoral Artery.*—The superficial pudic—two branches, an upper and a lower—pass inwards over the pectineus muscle, but under the fascia lata, to the skin of the penis, and the scrotum or the labium pudendi; the superficial epigastric, and superficial circumflex iliac pass; the one forwards through the saphenous opening in the fascia lata, and then upwards in the superficial fascia on the lower part of the abdomen; the other branch, outwards across the psoas and iliacus muscles, under the fascia lata, towards the anterior superior spine of the ilium. The *deep femoral branch* or the *profunda* is nearly equal in size to the continuation of the femoral artery after giving off this, the largest branch. Hence the femoral trunk is spoken of as the common femoral artery, this large deep branch as the deep femoral, and the continuation of the common trunk as the superficial femoral artery. The deep femoral arises from the outer and posterior part of the common femoral artery, from an inch to two inches below Poupart's ligament. Inclining outwards over the iliacus muscle—and there giving from its outer side the external

circumflex branch, and near it, the internal circumflex branch from the inner and back part of the vessel—the artery curves inwards and downwards over the pectineus, behind the femoral vessels, to gain their inner side; and passing behind the adductor longus, this deep artery continues down between that muscle and the short and great adductors; there dividing into three perforating branches, which penetrate these muscles close to the linea aspera, to reach the muscles at the back of the thigh.

The profunda *lies*, successively, in front of the iliacus and pectineus, the adductor brevis and adductor magnus, muscles. Placed at first to the outside, and crossing inwards behind the superficial femoral; it then runs parallel to it, but deeper by the thickness of the adductor longus muscle beneath which it passes. The deep femoral *vein* accompanies the course of the artery, but superficial to it; thus being interposed between the deep and superficial femoral arteries. And where the deep artery crosses inwards behind the superficial artery, the superficial femoral vein passes outwards between these vessels; thus making *both* femoral veins *between* the two arteries at that point—about the apex of Scarpa's triangle; just below which, the long adductor muscle separates the arteries and their accompanying veins.

The anastomotic branch, the last-named branch of the (superficial) Femoral, passes off near the opening in the adductor magnus; it gives a superficial offset with the saphenous nerve, and a deep articular one in front of the tendon of the adductor, which arches outwards across the front of the lower end of the femur.

*Operation.*—(1) The *common femoral* artery may be ligatured, by an

FIG. 73.



incision over its course, between the inferior margin of Poupart's ligament and the origin of the deep femoral—about one to two inches below. But the results of this operation have been most unsuccessful, owing to the shortness of the trunk in this situation, and consequent freedom of the collateral circulation.

(2) The *superficial femoral* is easily reached as it passes out of Scarpa's triangle, under the inner border of the sartorius muscle. If the limb be rotated outwards, a line drawn from midway between the symphysis pubis and the anterior superior spine of the ilium, downwards to the inner side of the patella, will about indicate the direction of the vessel. An incision, in this line, three or four inches long and passing over the sartorius, leads to the artery in some part of the incision where that muscle crosses the artery. (Fig. 73.) If the outline of the sartorius be perceptible, as in a thin person, the inner border of the muscle will be the best guide; along



which the incision may be made. Dividing the skin and superficial fascia, and avoiding any large branch of the saphena vein, the thin, bluish-white, fascia lata should then be cautiously divided or slit up on a director to the same extent. A branch of the internal cutaneous nerve may now be seen, and avoided, lying on the sheath of the vessels. The artery, with the vein inclining from the inner side behind it—to gain the outer side—are to be gently separated; and the needle introduced between them. Proper care must be taken to avoid wounding the vein or including it in the ligature; and the usual precaution observed of testing the aneurismal pulsation, by compression with the finger on the presumed artery, before tightening the ligature.

In *Hunter's Canal*, the superficial femoral was originally ligatured by John Hunter for popliteal aneurism, in the operation which he introduced; but it is not practised now-a-days, on account of the difficulty of reaching the artery in this the deep part of its course, compared with the facility of applying a ligature in Scarpa's triangle.

LIGATURE OF THE POPLITEAL ARTERY.—*Surgical Anatomy*.—In continuation of the superficial femoral, the popliteal artery extends from the opening in the *adductor magnus*, over the back of the lower third of the femur and knee-joint, to the lower border of the *popliteus muscle*; where it bifurcates into the anterior and posterior tibial arteries. It thus passes through the popliteal space or ham. In *direction*, this artery inclines from the inner side of the thigh—its lower third—to the middle of the knee-joint, posteriorly, and thence descends vertically to its termination. The *depth* of the vessel is greatest above the joint, and comparatively superficial over it, but deeper beneath the heads of the gastrocnemius muscle, to the lower border of the *popliteus*.

The popliteal artery *lies*, at first opposite to, but not in contact with, the lower third of the posterior surface of the femur, which curving forwards occasions the interval; then, the posterior ligament of the knee-joint; and lastly, beneath the gastrocnemius, on the *popliteus muscle*. The *lateral relations* of the artery are the muscles bounding the popliteal space.

This space is formed by an interval between the attachments of the muscles, behind the knee, to the condyles of the femur. The popliteal space is lozenge-shaped when the muscular boundaries are allowed to fall aside, by removal of the ensheathing fascia lata. The flexor or hamstring muscles of the thigh diverge over the lower third of the back of the femur to their insertion; namely, the biceps, externally to the head of the fibula; the semi-tendinosus and semi-membranosus muscles, internally, to the tibia, the sartorius and gracilis muscles also intervening between them and the femur; below, the fleshy heads of the gastrocnemius converge from their origin above the outer and inner condyles of the femur, and unite just below the joint,—but above the lower border of the *popliteus muscle*. The plantaris muscle also, arising from the line above the outer condyle under cover of the gastrocnemius, forms an additional lateral boundary to the popliteal space, externally.

The popliteal artery extends through the popliteal space, and a little way lower down than its inferior boundary, the united heads of the gastrocnemius, for the artery terminates at the lower border of the *popliteus muscle*.

A small branch of the obturator nerve, from the plexus in the middle of the thigh, descends upon the femoral artery, and into the popliteal space, on the popliteal artery.

The *popliteal vein*, and *internal popliteal nerve*—one of the divisions of the great sciatic—accompany the artery through this space, and beyond it; having the same extent as that vessel, or to the lower border of the popliteus. The vein is superficial to, and in contact with, the artery. Above the joint, it lies somewhat to the outer side of the artery; over the joint, it overlays and conceals the artery between the heads of the gastrocnemius; and under that muscle, it inclines across the artery lying to its inner side at the lower border of the popliteus. The nerve, superficial to the vein, has the same relations to it, and thence to the artery beneath the vein. Thus above, the nerve lies to the outer side of the vein; over the joint, on the vein between the heads of the gastrocnemius; and under that muscle, it crosses the vein—and artery beneath—lying to its inner side at the lower border of the popliteus. The *external popliteal nerve*—the other division of the great sciatic—descends obliquely outwards along the outer side of the space close to the biceps muscle, to just below the head of the fibula; having, therefore, no relation to the artery.

Overlapped above by the muscles, bounding the space, especially by the semi-membranosus, the popliteal artery is thus concealed, as well as partly by the vein and nerve, and also by a quantity of fat in which are imbedded a few small lymphatic glands around the artery; over the joint, the artery—with the vein and nerve—is *covered* only by the skin, superficial fascia, and fascia lata; but below the joint, by the gastrocnemius also, beneath which the small fleshy belly of the plantaris muscle crosses inwards over the popliteal vessels and nerve. The fascia lata ensheathing the limb, holds the muscles together, and conceals the popliteal space; the line of separation between the muscles bounding the space, being indicated only by a slight vertical depression on the fascia lata, in the middle line. The *small sciatic nerve* descending along the back of the thigh, beneath the fascia, nearly corresponds with this depression; and a little below the knee it perforates the fascia to become subcutaneous. The external or *short saphenous nerve*, a branch of the internal popliteal, descends, beneath the fascia, between the heads of the gastrocnemius to the middle of the leg; perforating the fascia, it is joined by a communicating branch from the external popliteal, and accompanies the external saphenous vein. The external or *short saphenous vein* coursing up the back of the leg, in the superficial fascia, passes between the heads of the gastrocnemius, and perforates the fascia there, or lower down, to enter the popliteal vein. It thus lies over the course of the short saphenous nerve, separated by the fascia lata.

The *Branches* of the popliteal artery are not of much importance, surgically. Supplying the muscle, and the joint; the latter branches are the superior articular—inner and outer; the inferior articular—inner and outer; and the azygos which enters the back of the joint through the posterior ligament.

*Operation.*—The popliteal artery is reached by a vertical incision, in the middle line, from about three inches above the centre of the popliteal space and carried down to the extent of four inches. Dividing the skin, superficial fascia, and fascia lata; the tendon of the semi-tendinosus is exposed internally, and the incision continued cautiously along its inner border. The internal popliteal nerve and the popliteal vein are seen, particularly the latter, lying superficial to, and somewhat to the outer side of the artery. Slightly flexing the joint, the semi-tendinosus and semi-membranosus muscles are drawn inwards with a curved spatula; the vein being gently separated from the artery, it is protected in like manner externally, thus bringing the vessel more clearly into view;

and the aneurism-needle should then be passed from without inwards, between the vessels.

**LIGATURE OF THE ANTERIOR TIBIAL ARTERY.**—*Surgical Anatomy.*—The anterior tibial artery extends from the *bifurcation* of the popliteal at the lower border of the popliteus muscle, to the front of the *ankle-joint*; thence to the posterior part of the first interosseous space, it is named the *dorsal artery of the foot*. *Directed*, at first forwards, through the aperture above the interosseous membrane, the anterior tibial passes downwards and forwards to the foot. Situated externally to the shaft of the tibia, in the upper two-thirds of its extent; the artery inclines in front of the tibia, in the lower third.

*Deeply* placed above, between the muscles, in the upper two thirds of its course; it becomes superficial below, between their tendons, and in front of the tibia and ankle-joint.

The anterior tibial artery *rests* on the interosseous membrane, and then on front of the tibia and ankle-joint. It lies *between* the muscles above; first, between the tibialis anticus internally, and the extensor longus digitorum externally, in the upper third of its course; and then between the same muscle internally, and the extensor proprius pollicis externally; but beneath the anterior annular ligament, the tendon of the latter muscle crosses over the vessel to the inner side. The *venæ comites* surround the artery with cross branches, particularly above. The *anterior tibial nerve*—a division of the external popliteal—winds round from below the head of the fibula between it and the peroneus longus muscle, then inwards beneath the extensor longus digitorum, and, between the tibialis anticus and extensor longus, it inclines downwards to the artery about the middle of the leg; crossing the vessel once or twice in its course, the nerve is still external at the ankle-joint.

*Overlapped* laterally, by the fleshy bellies of the three muscles between which it lies; the artery is *covered* only by the skin, superficial fascia, and aponeurotic fascia; but beneath the anterior annular ligament, it is crossed by the tendon of the extensor pollicis from without inwards. The aponeurotic fascia is attached to the crest or spine of the tibia and to the outer margin of the shaft of the fibula; thus binding down the muscles in their relative position. Intermuscular septa, indicated by white vertical lines, pass in between the muscles dividing them into three groups; an anterior extensor group of three, between the shafts of the tibia and fibula; an external or peroneal division of two, on the outer surface of the fibula; and the flexor muscles, on the back of the leg. The extensor muscles are separated by an intermuscular septum between the tibialis anticus and extensor longus digitorum. This septum can be readily recognised through the integuments when the foot is extended, the fleshy bellies of the muscles above rising up, and thus indicating the line of the septum. The anterior annular ligament of the ankle, a thickened portion of the aponeurotic fascia, consists of an upper and lower portion; in the latter there are three sheaths for the tendons of the extensor muscles—an inner one for the tibialis anticus, an outer for the extensor longus digitorum, and a middle, intermediate sheath for the extensor pollicis. The artery behind the latter tendon, is separated from it by the sheath.

The *branches* of the anterior tibial artery are, muscular offsets, and named branches; the recurrent, ascending in the tibialis anticus to the knee-joint; and malleolar, internal and external, which pass horizontally over the ends of the tibia and fibula.



The *dorsal* artery of the foot, continuing the anterior tibial from the front of the ankle-joint to the posterior part of the first interosseous space, sinks into the sole of the foot to communicate with and complete the plantar arch. In its course, the artery *rests* on the astragalus, scaphoid, and internal cuneiform bones; it lies *between* the tendon of the extensor pollicis internally, and the inner tendon of the extensor brevis digitorum externally, as far as about half an inch before the artery sinks into the sole, where this tendon crosses obliquely over to the inner side; the vessel is *covered*, otherwise, only by the skin, superficial, and aponeurotic fascia, here a very thin membrane. Two *venæ comites* accompany the vessel, also the anterior tibial nerve, which still lies external; becoming cutaneous in the first interosseous space, to supply the opposed sides of the great toe and the next.

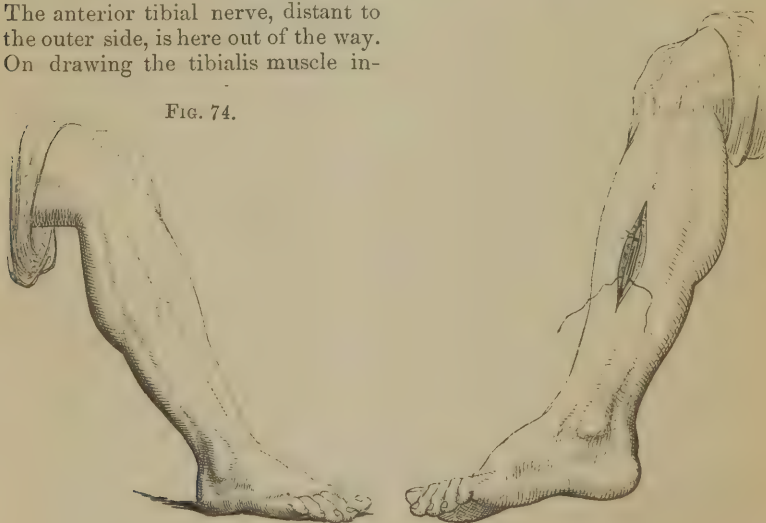
The *branches* are—a tarsal branch, which arises opposite the scaphoid bone, and passes under the extensor brevis to the outside of the foot; and a metatarsal branch, which forms an arch across the foot, under the extensor, near the bases of the metatarsal bones.

*Operation.*—The intermuscular septum is the best guide to the anterior tibial, between the fleshy bellies of the tibialis anticus and extensor communis, and continued down between the former muscle and the extensor pollicis. Or, a line drawn from the inner side of the head of the fibula to the centre of the ankle, will indicate the vessel, throughout its course.

In the *upper third* of the leg; an incision from two to three inches in length, between the extensor communis and tibialis (Fig. 74), leads down to the artery, deeply placed under cover of the latter muscle. The anterior tibial nerve, distant to the outer side, is here out of the way. On drawing the tibialis muscle in-

FIG. 75.

FIG. 74.



ward, the artery is seen with its *venæ comites*, and the ligature may be passed from either side of the vessel. (Fig. 75.)

In the *lower two-thirds* of the leg; an incision, less in length and depth, will find the artery between the less fleshy portions, or between the tendons, of the extensor pollicis and tibialis anticus (see Fig. 74);

but in the lower third, the artery inclines in front of the tibia, with the tendon of the former muscle approaching to cross over it. The anterior tibial nerve, from about the middle of the leg, may be seen accompanying the artery and its *venæ comites*. Drawing the tendons aside, with the nerve, the vessel is easily ligatured from either side.

The *dorsal artery* of the foot can be readily reached by an incision along the outer side of the tendon of the extensor pollicis (see Fig. 74), dividing only the skin, superficial fascia, and aponeurosis. The artery is seen between this tendon and the inner tendon of the extensor brevis digitorum, externally, or which may pass over it to the great toe.

**LIGATURE OF THE POSTERIOR TIBIAL ARTERY.**—*Surgical Anatomy.*—Continuing the popliteal artery from its *bifurcation* at the lower border of the popliteus muscle, the posterior tibial thence extends to the lower border of the *internal annular ligament*; there terminating in two plantar arteries for the sole of the foot. Its *direction*, at first, is vertical midway between the tibia and fibula, but inclining inwards it descends over the lower end of the tibia, posteriorly, and then in the middle of the hollow between the inner ankle and heel. Very *deeply* placed above, under the muscles of the calf, it becomes more superficial, behind the tibia, and inner malleolus.

The posterior tibial artery *lies*, at first on the tibialis posticus muscle, but passing inwards, on the flexor longus digitorum and lower end of the tibia and ankle-joint. In the upper half of its course, the artery lies *between* the tibialis posticus and the fleshy bellies of the gastrocnemius and soleus muscles, which conceal it; in the lower half, it lies between the tendo-Achillis and inner margin of the tibia. Behind the inner malleolus, the tendon of the flexor longus pollicis is external, and the tendons of the tibialis and flexor longus are between the artery and the malleolus. Two *venæ comites* surround the artery with cross communicating branches. The *posterior tibial nerve*, a continuation of the internal popliteal at the lower border of the popliteus muscle, lies internal to the artery for about one inch and a half; but crossing to its outer side, it continues to have that relative position down the leg to the interval between the malleolus and heel, there lying immediately to the outer side of the vessel, between it and the tendon of the flexor pollicis.

*Covered* by the gastrocnemius and soleus muscles, as far as the middle of the leg; the artery below is covered only by the skin, superficial and aponeurotic fascia. The annular ligament—a thickened band of the aponeurosis—stretches across between the inner malleolus and os calcis. It sends inwards three sheaths for the tendons of the flexor muscles; an inner one for the tibialis posticus, behind which is another for the flexor longus, and externally, near the os calcis, is a third for the flexor pollicis.

*Branches*—The *peroneal*, almost equal in size to the posterior tibial, arises about one inch and a half below the border of the popliteus muscle, where the posterior tibial nerve crosses the artery to the outer side; passing outwards between the muscles to the fibula, it descends somewhat under cover of that bone and in the fibres of the flexor pollicis, to the aperture below the interosseous membrane; there sending a branch forwards, and another between the tibia and fibula to the outer side of the foot. Other branches of the posterior tibial are of smaller size; some are muscular in the course of the artery, and an anastomotic communicating branch passes outwards across the lower end of the tibia.

*Operation.*—*High up*, under cover of the gastrocnemius and soleus muscles, the posterior tibial may be reached by a free incision between

the margin of the tibia and the gastrocnemius. (Fig. 76.\*) This incision must be continued down to the tibial origin of the soleus, which is then to be divided; both these muscles are drawn back, aided by flexure of

FIG. 76.



the leg and extension of the foot to relax the muscles; the artery with its venæ comites will thus be found, and the nerve to the outer side or crossing to that position. (Fig. 77.) The introduction of an aneurism-needle and securing a ligature, may prove very difficult, owing to the depth of the vessel. This operation was condemned by Mr. Guthrie, as "difficult, tedious, bloody, and dangerous;" and he proposed a substitute, which was practised by Mr. Arnott in a case where he

ligatured the posterior tibial artery for a wound of that vessel, high up.

Having applied a tourniquet to the femoral or popliteal, an incision six or seven inches long, is made down the middle of the calf of the leg, over the skin-wound, as nearly as possible, or leading down to the artery

FIG. 77.



at its wounded point. The gastrocnemius and soleus muscles must be divided freely, their opposed surfaces being recognised successively as tendinous expansions; the under surface of the soleus having been reached, the muscles are held aside with curved spatulæ, and a thin bluish-white aponeurotic septum between the muscles of the calf and the tibialis posticus, comes into view. Immediately beneath this septum the posterior tibial vessels and nerve will be found, lying on that muscle. But, as in the arm, the horizontal process of the aponeurotic fascia which thus separates the superficial and deep layer of muscles, is commonly very indistinct and indeed merely cellular in the upper part of the leg.

Scraping away this thin membrane, the artery is ligatured above and below the wounded point, including, probably, the venæ comites and some surrounding muscular tissue.

Low down, behind the inner malleolus, the artery can be readily secured by an incision midway between the malleolus and the tendo

\* The line of incision in this Fig. is more adapted for the lower half of the artery.



Achillis. (See Fig. 76.) Dividing only the skin, superficial fascia, and aponeurosis, the artery is found with the nerve to its outer side. By extending the foot, and turning it slightly inwards, to relax the flexor and tibial muscles, the ligature can be at once passed and tied.

The *peroneal* artery may be reached by an incision along the outer border of the fibula, between it and the gastrocnemius. The flexor longus pollicis must then be either partly divided or drawn outwards, when the artery will be found in the fibres of that muscle and running close under the fibula. The ligature must be passed as best the Surgeon may be able. This operation, like that on the posterior tibial higher up, is more easily described than done.

## CHAPTER XXVI.

### DISEASES OF ARTERIES.

**ARTERITIS.**—*Structural Conditions.*—Inflammation of any portion of the arterial system produces structural alterations in the coats of the vessel, similar to those resulting from inflammation of any other texture. Increased vascularity, and interstitial exudation of fibrinous matter, renders the coats of a bright red colour, thickened and pulpy; the interior of the artery, in particular, has a crimson hue, as though some irritating fluid had been injected into the vessel, and it is lined with a slight lamella of lymph here and there, whereby the coats becoming fused, the vessel loses its elasticity. The blood within the vessel undergoes coagulation and forms a plug which more or less completely blocks up the vessel, thus rendering it impervious as a blood-conveying tube, and below which the calibre of the artery is somewhat contracted. This plug, conical in shape, consists partly of yellowish fibrinous exudation, occupying its base and adhering to the interior of the vessel, and partly of ordinary black coagulum, which forms apparently on this inflammatory portion, and, tailing off to some distance, is not adherent to the vessel. This condition is denominated *Adhesive Arteritis*. Inflammation, with the secretion of pus, instead of fibrine, from the interior of the vessel, may perhaps occur sometimes, and it is probably of a spreading character; but whether the purulent matter be true pus, or disintegrated fibrine, remains, I think, to be determined by further observation. This condition constitutes the *Suppurative* and *Diffuse Arteritis* of some authors.

The *Symptoms* of Arteritis are referable both to the vessel affected, and to the part which it supplies with blood. Induration, and a cord-like feeling of the vessel when passed under the finger, arises from the thickening of its coats, and coagulation within the tube. Pain of a remarkably twofold character is experienced—a superficial sensitiveness of the skin over the artery, and a deep burning or lancinating pain in the course of the vessel, and striking through the limb. But any redness or heat in the inflamed part will scarcely be perceptible. The pulsation is peculiarly thrilling or jerking, but diminishing, it at length ceases. Below the part supplied by the vessel, the temperature declines, accompanied with a sensation of weight and fulness, and a loss of voluntary power. Gangrene is imminent. The *general* symptoms are those of inflammatory fever, speedily subsiding into prostration.

*Causes.*—Arising usually from some form of injury—a blow, a strain, a wound, or the application of a ligature, arteritis may also proceed from some constitutional condition of obscure nature. Some blood-condition, probably, representing what is termed a broken constitution, seems to be the cause of the diffuse form of arteritis. The traumatic and constitutional modes of origin may co-operate.

*Course and Terminations.*—(1) Absorption of the coagulum may take place, the artery regain its natural calibre, and the circulation be fully restored. (2) Or the coagulum remaining and extending, gangrene, in the dry form of mortification, supervenes, the artery undergoing contraction and obliteration as a fibro-cellular cord. Gangrene may be prognosticated, in proportion to the degree of occlusion, its suddenness, and the size of the arterial trunk. Absorption, or rather, transmission of the fibrinous exudation in a state of disintegration, or of pus if secreted, would seem to occur in some cases, and give rise to the symptoms of *Pyæmia*. This event is, perhaps, more especially incident to diffuse arteritis.

*Treatment.*—Local blood-letting, by means of leeches applied in the course of the vessel and warm fomentations, will be appropriate, followed by calomel and opium, to prevent fibrinous exudation, and alkaline salines to promote disintegrative solution of the coagulum. But certain measures, remedial in relation to inflammation or its consequences in other textures, are here inappropriate; the arterial system, in part at least of its extent, being itself the seat of inflammation. Thus, stimulants, in their beneficial influence on the general circulation, might increase the exudation of fibrinous matter within the vessel inflamed, and induce gangrene. Stimulating applications also, as mercurial inunction, to promote absorption of the exudation would be similarly hazardous.

The treatment of gangrene, medicinally, and with reference to amputation, and also of any pyæmic symptoms, presents nothing peculiar.

*OSSIFICATION OF ARTERIES.—Structural Condition.*—Ossification or calcareous degeneration of the coats of arteries—as relating to the principal arteries of the leg—was noticed by Thomson and Hodgson, in connexion with the dry form of mortification of the toes and feet; and which being incident to old age, or premature old age, is known as Senile Gangrene. Sir B. Brodie more particularly investigated the pathology of this disease, and according to his observations, the structural changes are summarily these:—In the leg, calcareous degeneration of the larger arteries, and fibrous thickening of the smaller ones, are accompanied with more or less contraction of the vessels, and perhaps the coagulation of fibrine within them; conditions which, together, produce a partial or complete obliteration of the channels through which arterial blood should be supplied.

*Symptoms.*—In either or both legs; numbness, coldness, and weakness arising from a defective supply of arterial blood; these symptoms come and go; they are present, whenever circumstances demand a more active circulation, which the unyielding arteries cannot allow; absent when a sluggish circulation is sufficient. Thus, rest, posture, and warmth may maintain this sufficiency; while active exercise, and any posture or pressure that further impedes the circulation is soon attended with a sense of weakness in the limb, numbness, and coldness. Flying pains in the limb, or fixed pain in a spot, are sometimes experienced. Under

these functional symptoms, as affecting one or both legs, gangrene is always more or less imminent.

*Senile Gangrene.*—Commencing, generally, on the pulpy portion of one or more of the toes, a port-wine red colour or a black discoloration appears, preceded by inflammation, or by a stinging sensation, or by numbness and coldness, as *premonitory* symptoms; but frequently without any such precursory local symptom. Soon a vesicle arises over this discoloured spot, or more than one vesicle. The vesicle or vesicles burst, disclosing the true skin in the blackened state of sphacelus. It is encircled with a dusky red hue. This death-warrant advances, perhaps, slowly, extends over the toes and back of the foot, uniformly and symmetrically, followed up by the black shade of sphacelus. Spreading up to the instep, senile gangrene presents the appearance as if the foot were thrust into a black slipper trodden down towards the heel. The dead part is black, shrunken, and mummified—the very type of *dry* gangrene. If both feet be affected, a pair of black hoofs is presented. (See Fig. 30.) It spreads to a variable extent; gaining the ankle, life usually succumbs to the consequent constitutional depression; occasionally, it may extend as high as the knee, or even to the thigh. But the possible extent is unknown, and cannot be determined during life, the causative condition of the arteries being undeterminable. Nature alone decides the “line of demarcation” betwixt the living and dying parts. The accompanying constitutional disturbance or fever, is of the typhoid type.

*Causes.*—The inelastic, and contracted or obliterated state of the arteries, is the structural cause in operation; but this is, frequently, a *predisposing* condition, although maintaining the gangrene when established. Some slight injury to the foot—an abrasion, scratch, or wound—is commonly the *immediate* cause, the gangrene being so far *traumatic*. Sir B. Brodie offers a reasonable explanation. During inflammation, an increased supply of arterial blood is required, and the arterial trunks leading to the inflamed part become dilated so as to permit this extra quantity; but, when these vessels are ossified, they lose their dilatability and power of accommodation, the greater supply of blood demanded by inflammation is withheld, and the part perishes. *Age* is certainly a *predisposing* cause, in virtue of the degenerative changes which the arteries, in common with other textures and organs, undergo as life advances. Hence, ossific degeneration of the arteries is liable to occur in persons past the middle period of life, say fifty years of age; those who are old in years, or in those who are prematurely old for their years. Either sex is liable to this degenerative change, though perhaps not equally so.

The *duration* of senile gangrene is uncertain. It may continue for a few weeks or months, even a year, and terminate fatally. Or, if limited to a toe or two, the part may be detached naturally, by the formation of a line of demarcation and ulcerative severation, or, be removed surgically; and in either case, the patient recovers.

*Treatment.*—*Preventive* measures—in those who have had, from time to time, premonitory symptoms—will consist, in the avoidance of the circumstances, which disturbing the circulation, are the immediate causes of senile gangrene. Hence, attention to rest, posture, and uniform warmth of the legs by clothing; gangrene commencing usually, after a walk, long standing, or exposure to cold. Then again, the Surgeon should avoid the slightest operation, even the laying open of a sinus on the foot; if the patient has been subject to premonitory symptoms. Sir B. Brodie relates



a case in his early practice, where such an operation—trifling in itself—gave rise to inflammation, gangrene of the whole foot on the following day; and in two days more, death ensued.

The treatment of (senile) *gangrene*, is both local and constitutional. The *local* indication is, to solicit the formation of a line of demarcation or limitation of the gangrene, and thus also restrict the extent to which it might otherwise have spread. Hence, to maintain the temperature of the foot or feet, in order to diffuse the local circulation and sustain the vitality of the part; a condition necessary for Nature to declare the line of severation between the living and dead portions. Cotton-wool padding, deeply enveloping the limb, is most effectual; and it need not be reapplied for some days, the gangrenous part being previously covered with lint soaked in chlorinated, carbolic, or other antiseptic lotion. *During* the process of separation, reparative closure of the vessels, by adhesive inflammation, should be promoted by poulticing or an epithem of spongio-piline soaked in warm water. When the soft textures are detached; the bones may be sawn through, and the otherwise natural amputation aided by this amount of surgical interference. Any earlier, or more actual amputation, might or would excite inflammation and thus perhaps start the gangrene afresh. The *ulcer* left by the part removed, is a simple or healthy, healing sore. Thence, during granulation and cicatrization, water-dressing may suffice, or a slightly stimulant lotion, as balsam of Peru, pure or diluted, with an equal part of yolk of egg. Subsequently, the internal cause of gangrene, ossification of the arteries, still being persistent; exposure to cold must ever be avoided, and the circulation cherished by the patient wearing thick woollen socks and flannel drawers.

*Constitutional* treatment will depend on the stage of the disease. During the *typhoidal* fever, consequent on gangrene, prior to closure of the vessels; supporting measures are indicated, an easily assimilated diet of principally animal food, with malt liquor, and wine or alcoholic stimulants. Bark, ammonia, and chlorate of potash are accessory only as a medicinal tonic and stimulant. Opium is peculiarly efficacious; the tincture, in small but repeated doses, to the amount of two to four grains in the twenty-four hours, and increased as the system is brought under its influence. Headache, or disturbance of the digestive organs, will contra-indicate its use, or suggest its discontinuance. During the *inflammatory* fever which accompanies occlusion of the vessels, in the separation of the gangrenous part, or when otherwise present; opium should still be administered, to suppress the nervous excitement, while it sustains adhesive inflammation; and the general circulation and strength be supported by moderate diet, with a mild tonic and stimulant plan of treatment. Topical measures to regulate the inflammation, would probably provoke gangrene.

## VEINS.

## CHAPTER XXVII.

INJURIES.—VARICOSE VEINS.—PHLEBITIS.

WOUNDS OF VEINS.—See WOUNDS, Ch. XIV.

ANEURISMAL VARIX, AND VARICOSE ANEURISM.—See ANEURISM, Ch. XXIII.

VARICOSE VEINS, OR VARIX.—*Structural Conditions, and Diagnostic Characters.*—Varix signifies, an enlarged, elongated, knotty, and tortuous condition of the veins of a part; the knotty enlargements corresponding to the sinuses behind the valves in these vessels. Thickening or thinning of the coats of the veins, at different points, and destruction wholly or partially, of the valves; accompany these more perceptible changes of size and outline.

Certain more *minute* changes in the coats and valves of varicose veins, are thus described by Hassie; changes which constitute *different forms* of varix, and represent the order of their occurrence.

“In persons affected with a morbid preponderance of the venous system, we first of all observe an undue prominence of the veins of the skin. These appear in *dense nets* of branches, remarkable for their diffuse distribution, and are generally turgid with blood, or liable to become so from the slightest mechanical or dynamical causes—like what, under ordinary circumstances, would be the effect of violent and prolonged muscular exertion. In this condition of the veins, their *coats* have not undergone any absolute change, being everywhere proportionate to the width of the calibre; the vessels are not more than usually tortuous, and cannot as yet be called morbidly altered.

“After a while, however, they become permanently *dilated*, an occurrence more frequent in elderly than in young persons. This is brought about by a reinforcement of the fibrous texture of their *external coat*, in the shape of an accession of conspicuous transverse fibres. Meanwhile the internal membrane remains unchanged in structure, merely displaying numerous lines or superficial furrows running lengthwise, and the vessel still maintains its natural course, not assuming a more sinuous, but rather a straighter direction. It does not collapse, on section, but remains patent, and is distinguishable from the arteries by its colour, which is of the same pale-red as the fibro-felt texture constituting the normal external membrane of a vein. The *valves* remain unaltered. In this condition the saphena is frequently found in old persons, so also are certain branches of the vesical plexus, while other branches manifest still further changes.

In the greater number of instances, however, the external membrane of the vein is not thickened, but, along with the other membrane, undergoes considerable *attenuation*, in proportion as the vein becomes more and more dilated. Conformably with their irregular disposition, the intermediate fibres give way unequally, allowing the internal membrane to jut

out in *sac-like protrusions*, and to establish so many irregular, constricted, pear-shaped, and often in appearance, pediculated tumours. At the commencement of some of the smaller branches, the membrane thus forms pouch-like dilatations, or forces itself between the longitudinal fibres of the external membrane in lengthly protuberances, which exceed in circumference that of the vein in its natural state; or, it may, perhaps, distend cylindrically and pretty equably for a considerable length the intermediate fibres before alluded to. Meanwhile the *valves* become attenuated, and pulled asunder transversely, so as to be useless; in many instances they become partially or wholly obliterated, and are torn into shreds, or destroyed as far as their free border, which then runs across the diameter of the vessel like a filament or band, attached by the two extremities to the internal membrane. The veins now appear *elongated*, and their course very *tortuous*." The *blood*, at first fluid, is liable to undergo coagulation, occluding the channel of a varicose vein. A sensation of weight, fulness, and even pain, accompanies this double obstruction to the venous circulation—varicosity of, and coagulation within, the veins. But the symptoms referred to are not peculiar to this condition; and they are increased by exercise and the erect posture.

The veins most liable to become varicose, are, the subcutaneous and submucous. The internal saphena, and less so, the external saphena, are peculiarly liable; and form the varicose veins commonly seen. Less commonly affected, are the veins of the arms, abdominal parietes, the chest, external jugular in the neck, and the superficial veins of the head. The lower hæmorrhoidal veins around the anus, and the lower portion of the rectal mucous membrane, are frequently varicose; forming hæmorrhoids or piles, external or internal. The spermatic veins, around the cord in the scrotum, are not unfrequently affected, when the disease is named varicocele. Of deep-seated veins, those most liable to become varicose are, the internal jugular, the *venæ azygos*, and the prostatic veins.

*Causes.*—Any occasion of pressure on a venous trunk; or any cardiac obstruction to the free return of venous blood, or want of propulsive power of the heart, will induce varix. The veins of the lower extremities are so commonly the seat of this condition, owing to their distance from the heart, and the influence of gravitation. Habitually excessive walking exercise, or a standing occupation, operate in like manner. Wearing a tight garter below the knee, and the enlargement of the uterus during pregnancy; well illustrate the production of varicose veins by pressure, on the saphena or iliac veins. Disease of the liver and rectal constipation have a similar relation to hæmorrhoids. Certain *predisposing* causes may be noticed. The want of support by surrounding textures, predisposes superficial veins to become varicose. It is said that some degenerative change in the coats of veins, as in the arteries, may also be a provocative condition. Age has certainly a notable influence; the disease being rare in early life, and increasing as years advance. Sex seems to have some influence; varicose veins occurring more frequently in women; probably, chiefly, in connexion with the uterine conditions of pregnancy or the formation of a tumour.

*Course and Terminations.*—(1) Inflammation of the vein is very apt to supervene, and by increasing the liability to coagulation within the vessel, lead to further consequences; persistent œdema of the sub-cellular tissue, and ulceration, forming the *varicose ulcer*. (2) *Venous hæmorrhage*



may ensue, sometimes of an alarming character, in the event of this ulceration extending into the vein, or some large branch. Similar hæmorrhage may proceed from attenuation and bursting of a varicose vein.

*Treatment.*—The removal of any cause in operation; as any occasion of pressure or obstruction, will, of course, be the primary rule to be observed.

*Palliative* measures consist in rest, elevation of the part, and moderately firm, even, and continued compression of the veins, by means of bandaging with an elastic roller. (Figs. 78, 79.) These figures both show the mode of applying a roller-bandage to the leg. Commencing from the toes, each turn of the roller is made to *overlay* the preceding one, so that no intervals are left between the turns, through which the integument would become swollen; the turns are made with moderate, but *even* firmness, by a slight pull in completing each circle;

FIG. 78.



FIG. 79.



and *cross-turns* are made as the roller is carried up the leg, in order to adapt the bandage evenly to the increasing circumference of the leg—this manipulation being effected over the tibia by just fixing the bandage with the thumb of the left hand, as the cross-turn *downwards* is made, in carrying the roller around the leg. Fig. 79 also shows another mode of applying the bandage around the heel, and the previous cross-straping of a *varicose ulcer*, which often co-exists with varicose veins. Or an elastic stocking may be worn, as another mode of affording support to the enlarged and weakened veins. These appliances relate specially to varicose veins of the lower extremities; but a similar mode of treatment is applicable generally.

Varicocele and Hæmorrhoids are specially noticed in connexion with Diseases of the Scrotum and Rectum, respectively.

*Radical or Curative Treatment*, consists in obliteration of the Vein or Veins, by various operative procedures. They are none of them more than occasionally successful, and some are hazardous rather than curative.

The *twisted suture* may be applied at intervals along the course of the

vessel; with *subcutaneous* section of the portion of vein included between any two such sutures, placed about one inch apart. (Fig. 81.) The subcutaneous section is made with a fine narrow-bladed tenotomy knife—

FIG. 80.



straight or curved, as may be convenient. (Fig. 80.) The point of the knife is entered under the vein, and carried to the opposite side to just beneath the skin; then, by drawing the blade outwards, so that the point traverses a semicircle under the integument—as felt by the forefinger of the other hand, the vein is thus divided—its thickened structure cutting with a leathery resistance. This operation has already been

FIG. 81.



described in the treatment of Varicose Ulcer. It is the most successful, and least objectionable mode of obliterating varicose veins. In no case but one, have I seen any untoward event—sloughing, phlebitis or pyæmia; and in some cases, the cure has been permanent. It is the only mode of obliteration which I have recourse to. The suture part of this proceeding originated, I believe, with Velpeau; the subcutaneous section additionally, is due to Mr. Lee.

*Subcutaneous* section of the vein, without placing a suture-barrier on either side of the divided portion to guard either aperture, is always perilous; owing to the risk of pyæmic infection consequent on any phlebitis, which may thus be excited. *Excision* of a small portion of the vessel, is equally hazardous, as attested by Sir B. Brodie.

*Cauterization*, to excite inflammation of the vein, may be effected by the application of caustic potash or chloride of zinc, so as to produce eschars in the course of the vessel—the phlebitis advancing to adhesion, and stopping short of suppuration, within the vessel. But thence the risk of pyæmic infection. Yet this mode of inducing obliteration has been recommended by Seutin, Bonnet, and other Surgeons; and is particularly advocated by Mr. Skey, within certain limitations. He recommends the application of Vienna paste; potash in the proportion of two parts with three of lime, and spirits of wine being added to form a paste. The eschars should not exceed the size of a split pea, and their number be regulated by the extent of the varicose vein. Thus produced and restricted, they are said to be free from danger.

*Injection* of a few drops of the perchloride of iron, and the influence of *galvanism* transmitted through needles introduced into the vein, are modes of obliteration so questionable as to their efficacy, or their safety, that they need only be mentioned.

*Venous hæmorrhage*, occurring in the course of varicose veins; the bleeding may be arrested, temporarily, by digital compression—slight pressure with the point of the finger being quite sufficient; and per-

manently arrested, by a compress of lint, secured by a bandage, over the aperture in the vein, with elevation of the limb.

**PHLEBITIS.**—*Structural conditions.*—Inflammation of any portion of the venous system, produces structural alterations in the coats of the vessels similar to those resulting from inflammation of an artery. It may be *Adhesive* or *Suppurative*, but more commonly the latter; and both forms of Phlebitis are far more common than Arteritis.

The coats of an inflamed vein have a dark red colour, and have become thickened and pulpy owing to an interstitial fibrinous exudation; the inner coat, in particular, presents this hue—partly due to the imbibition of colouring matter from the blood, and a lamella of lymph is adherent to the surface. The blood within the vessel has undergone coagulation, more or less perfectly, forming a hard or soft blackish coagulum, mingled with the fibrinous exudation. Thus far phlebitis is *adhesive*. But, pus being readily secreted within the vessel; *suppurative* phlebitis may soon be established. If limited within the boundary of the coagulum and fibrinous exudation, above and below—the pus lying between the coats of the vessel and the coagulum, and between interrupted portions of the coagulum; this circumscribed form of suppuration has been named *limited suppurative phlebitis*. And, as the matter, thus occluded or imprisoned cannot be transmitted into the general circulation; this condition is not productive of pyæmic infection. But, if the plastic lymph-barriers within the vessel, above and below these collections of pus, give way; *diffuse* suppurative phlebitis ensues, and pyæmia will be inevitable. *Diffuse* phlebitis signifies a spreading form of the disease, but as this character is probably never unaccompanied by suppuration, the distinction seems unnecessary.

The *Symptoms* of Phlebitis are referable both to the vessel or vessels affected, and to the circulation in the part below. An inflamed vein is hard, cord-like, and knotted, under the finger, painful or tender on pressure; and a purplish redness with some degree of heat, may be perceptible in the course of the vessel. If the vein be varicose—a pre-existing condition not uncommon—these symptoms may be even more marked, and those of varix are superadded. The supervention of *suppuration* is denoted, in the limited or circumscribed form, by the symptoms of abscess in exchange for those of purely adhesive phlebitis. One or more small fluctuating swellings appear in the course of the vein; instead of its previously, uniformly hard, cord-like character, which thus becomes more knotty—hard here, and softened there. In the *diffuse* form of suppuration, the whole tract of the vessel softens down uniformly; fibrine, coagula, and pus commingling.

Obstruction to the venous circulation, arising from the fibrinous exudation and coagulation within the vessel, produces some œdema in the part below, or general swelling of a whole limb, if a large venous trunk be the seat of obstruction. In adhesive phlebitis this swelling will be *most* conspicuous. No blood passes through the femoral vein, for example, in this condition of phlegmasia dolens; an arrest of circulation which soon tells on all the tributary veins throughout the limb. Its cellular texture becoming gorged with serum, the whole limb is swollen, tense, and hard; of a polished, pearly-white colour, or mottled, cold and insensible—a marble limb, and much larger than its fellow. The *general* symptoms are those of inflammatory fever, very shortly subsiding into prostration; and pyæmia—as a consequence of diffuse suppurative phlebitis.



*Causes.*—Some form of injury is, commonly, the immediate cause of phlebitis; a wound, as in operations involving the veins, phlebotomy, or the application of a ligature. Some constitutional or blood-condition, probably, predisposes, or may be the predominant cause, in most cases. This causative condition is apparently akin to that of erysipelas.

*Course and Terminations.*—(1) Absorption seems to prevail in some cases; the coagulum becoming centrally pervious, and a channel thus forming, through which the venous circulation is re-established. (2) Or, obstruction continuing, the vessel becomes impervious, and, shrivelling into a fibrous cord, is obliterated; Gangrene threatens; in proportion to the degree of occlusion, its suddenness, and the size of the venous trunk. Such are the consequences of *Adhesive* phlebitis, more especially. *Suppurative* phlebitis may proceed to further consequences, local and constitutional. (3) Rupture of the vein, with the formation of abscess in the surrounding cellular texture, and sloughing. (4) Pyæmia is announced by rigors, great prostration, rapidity of pulse, with other symptoms of purulent infection; followed frequently by a fatal issue.

*Treatment.*—Local blood-letting, by means of leeches applied along the course of the vessel, and warm fomentations, may prevent adhesive phlebitis; by promoting resolution of the inflammation before fibrinous exudation and coagulation have supervened. Subsequently, alkaline salines may induce disintegration and absorption of materials occluding the vessel. But the administration of calomel and opium is of doubtful efficacy. Fibrinous exudation may, indeed, be thus prevented, in some measure; but the peril of *diffuse* suppuration will be facilitated. *Abscess* arising, it must be opened forthwith; and chronic œdema may be restrained by bandaging, or removed by blisters. Stimulants are more needed, and earlier, than in Arteritis; and they are less objectionable with relation to gangrene, which is rather a tendency only of the disease, than actually resulting from venous obstruction. *Pyæmia* cannot be overcome by any known remedial measures. Besides the treatment by opium, wine, or brandy, and egg mixture, freely administered; Pirrie recommends the tincture of the muriate of iron, in doses of 25 drops every 4 hours.

**PHLEBOLITHS, OR VEIN-STONES.**—Small concretions are not unfrequently formed within various veins, more particularly in the iliac and its branches. These bodies are either free, or attached to the interior of the vessels, cropping in and gathering fibrine around themselves as the stream of blood eddies slowly by. One such body, situated in a principal vein, as either common iliac, might become a cause of serious obstruction to the return of blood from the whole lower extremity.

The *diagnosis* would be difficult or impossible, the occluding concretion being discovered only after death. Fortunately, however, when venous obstruction is gradually established, an adequate compensation is provided by the simultaneous enlargement of other veins, as collateral channels, for the return of blood. The obscurity of diagnosis, and this compensation, render vein stones of little practical interest.

## LYMPHATICS AND GLANDS.

### CHAPTER XXVIII.

#### LYMPHATITIS.—TUMOURS.

**LYMPHATITIS.—INFLAMMATION OF THE LYMPHATICS, OR ANGEIOLEUCITIS.**—*Structural conditions.*—The walls of the lymphatic vessels, when inflamed, are thickened and softened, and the surrounding cellular tissue is infiltrated with fibrinous exudation. Similar exudation mingling with the lymph within in the vessels, forms a rosy clot, obstructing their interior. *Suppuration* often ensues *limited* as an abscess, or a chain of abscesses along the course of the vessel; or as *diffuse* infiltration.

The *Symptoms* are referable both to the vessels affected, and to the part. Inflamed lymphatics present purplish-red linear streaks, tortuous and intersecting, not necessarily continuous with the source of inflammation, but running up to the neighbouring lymphatic glands, which also become involved. Erysipelatous patches frequently appear, having the same distribution, and render the islets of unaffected skin between the lymphatics more conspicuous. These red lines are hard and cord-like under the finger, and beset with a spongy swelling—the surrounding infiltration. A hot, burning pain, and tenderness on pressure, also corresponds with the course of the vessels. These symptoms are more marked when the superficial lymphatics are affected, and may be scarcely perceptible when the deeper lymphatics are principally the seat of inflammation. *Suppuration* is made known by the usual symptoms of abscess, or by those of *diffuse* suppuration, in the event of this condition prevailing. Considerable œdema of the part—possibly a whole limb—supervenes, as the vessels become occluded; and this symptomatic condition is more intense with inflammation of the deeper lymphatics. The *general* symptoms will be those of inflammatory fever, soon exchanged for prostration, or sinking into the collapse of pyæmic infection.

*Causes.*—Usually arising from some form of injury—a wound, or friction, or from the absorption of some poisonous matter, as by a dissection wound; the external and local cause of lymphatitis is frequently a trilling lesion. Some constitutional condition would appear to prevail in most cases; and this, probably, is of the erysipelatous nature.

In persons of a broken constitution, and those who are in a low state of health, inflammation of the lymphatics readily occurs, and often from scarcely perceptible external causes; the pressure of a tight boot, inducing a few reddish streaks on the inner side of the leg and thigh, with swelling and tenderness of the inguinal glands; or a slight abrasion on the hand being followed by similar inflammation of the lymphatics along the inner side of the arm extending to the axillary glands.

*Course and Terminations.*—(1) Resolution occurs not unfrequently, even in those who seem most susceptible of the disease. The reddish streaks fade away, and the œdema subsides. (2) Or, inflammation having ceased, the indurated cords may remain, with brawny swelling, for some

time. (3) Suppurative lymphatitis often leads to the formation of abscesses in the surrounding cellular texture, and possibly, sloughing. (4) Pyæmic infection is a frequent consequence, proceeding, probably, from the direct transmission of pus from the interior of the vessels.

*Treatment.*—The application of a few leeches, along the course of the vessels, may be appropriate in the absence of an erysipelatous tendency; but warm fomentations, elevation of the limb, and rest, will always be suitable, and generally prove sufficient to reduce the inflammation. Alkaline salines, and other mild depletory measures are auxiliary at an early period.

Abscesses should be opened without delay, and chronic œdema is best overcome by careful bandaging and blistering. Stimulants will soon become requisite in the course of this disease. Wine, brandy, and ammonia must be freely administered; the latter, I think, has a depressing influence, when continued for any length of time; and any stimulant supplies only a prop, to be withdrawn in proportion as nourishing food can be taken and assimilated. The treatment of pyæmia, as a consequence of lymphatitis, presents nothing peculiar.

*INFLAMMATION OF LYMPHATIC GLANDS.—ADENITIS.—Structural Conditions.*—Inflammation of the lymphatic glands differs in no important particular from that of the lymphatic vessels. Their structural resemblance explains this pathological affinity, for these glands, each consist of lymphatic vessels in the form of a network; connected by cellular tissue into a dense mass, enclosed in a cellular capsule. The lymphatics entering a gland and forming the network, are again collected into lymphatic trunks issuing from the gland. Capillary blood-vessels ramify on this network of lymphatics, and are thus brought into an intimate relation with them, anatomically and physiologically. Inflammation of the lymphatic glands is attended with some thickening of the conglomerated vessels, and infiltration of the interstitial cellular tissue with fibrinous exudation, but seldom with any permanent obstruction of the interior of the vessels. Suppuration not unfrequently takes place, forming an abscess, either centrally in the substance of the gland, or in the external and surrounding cellular texture.

The *symptoms* are simply those of ordinary inflammation; the gland becomes swollen, hard, and painful, with, perhaps, a blush of redness and heat in the superimposed integument. Induration is less notable, owing to the naturally firm consistence of the lymphatic glands; but they may acquire even a bullety hardness, as the inguinal glands in connexion with an indurated syphilitic sore. Softening may succeed in ordinary adenitis; and with suppuration, the usual symptoms of abscess supervene. Œdema commonly occurs in the part below, and proportionately as absorption becomes obstructed. The constitutional disturbance is the inflammatory type of fever, and often more acute than with inflammation of the lymphatic vessels.

*Causes.*—Usually occurring as a continuation of inflammation along the lymphatics, adenitis sometimes arises independently, from an injury, or from absorption of noxious matter, not affecting the intermediate vessels. A sprain or an ulcer may thus induce inflammation of the glands distant from the seat of either; as the inguinal glands, when the foot or shin is the source, the intervening lymphatic vessels remaining unaffected.

*Course and Terminations.*—(1) Resolution occurs in many cases of



ordinary inflammation. (2) Chronic enlargement and induration is not uncommon. (3) Suppuration may be followed by sloughing, and exposure of the glands, as reddish grey, fleshy masses, notwithstanding the destruction around them.

*Treatment.*—Leeches are seldom necessary; fomentation, rest, and relaxation by position, generally being sufficient to resolve the inflammation, aided by mild depletory measures medicinally. *Suppuration* threatening, the same treatment should be continued, and warm spongio-piline fomentations or poulticing having been assiduously employed for a few days, a bistoury should at once be introduced, and any matter set free ere burrowing has taken place. Fistulous tracks are more apt to occur with suppuration around the gland; and stimulating injections or solid nitrate of silver will then, perhaps, succeed in exciting healthy granulation so as to close these passages; failing which, they must be slit up and healed from the bottom. *Chronic* induration of the lymphatic glands is best dispersed by the occasional application of iodine paint; but, if suppuration has taken place, and perhaps circumferentially, with fistulous openings through which portions of the glandular mass protrude, it will be requisite to destroy such a mass by introducing a stick of caustic potash into its substance and turning it freely about. Thus also any induration may be dissolved. A stimulant and tonic plan of treatment must take the place of any depletory measures, during suppuration or in chronic induration; and removal of the latter may, perhaps, be aided by iodide of potassium in conjunction with this treatment.

Extirpation of lymphatic glands in a state of chronic induration becomes necessary as a last resource. I have removed such glands; in particular, a conglomerate bunch of axillary glands, which was found to consist of degenerate gland-tissue, enclosing spots of yellow, curdy pus, and cretaceous matter. Fistulous openings afterwards proved troublesome, but these closed under stimulating injections.

ENLARGEMENTS, AND TUMOURS OF LYMPHATIC GLANDS.—*Scrofulous* enlargement of these glands. (See SCROFULA, Ch. V.) *Tumours* of these glands are noticed in connexion with MORBID GROWTHS. (Ch. II.)

## BONES.

### CHAPTER XXIX.

#### FRACTURE.

*FRACTURE.*—*Structural Conditions.*—Fracture is a solution of continuity of the osseous texture, suddenly produced; and the broken ends of bone are more or less contused or lacerated by the act of breaking. Fractures differ essentially in regard to the mode of their reparation, according as they are unaccompanied, or attended, by an open wound communicating with the fracture; the one being termed *Simple*, the other *Compound*. *Complicated* Fracture is also a recognised distinction; when the injury to the bone is accompanied with injury to other parts, as important blood-vessels or nerves, an internal organ, or extends into a joint (Fig. 82), or

is accompanied with dislocation. But any such additional injury is not an essential condition, as pertaining to the pathology of Fracture.

FIG. 82.

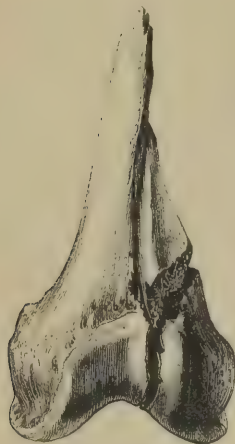
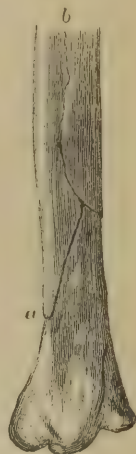


FIG. 83.



FIG. 84.



In its extent, a fracture generally passes completely through the bone—

FIG. 85.



*complete* fracture; occasionally, it is limited to part only of the whole thickness of a bone—incomplete, or as it is sometimes aptly termed, “greenstick” fracture. (Fig. 83.)

FIG. 86.



In direction, the line of fracture may be *transverse*, *oblique*, *a*, or *longitudinal*, *b*, as compared with the axis of a long bone. (Fig. 84.) But these purely anatomical conditions are not essential distinctions.

[P. p. 191.] If there be more than two, perhaps several, fragments, the fracture is *comminuted*. (Fig. 85.) *Impacted* fracture is that condition wherein one fragment is wedged into another, the compact structure being driven into the cancellous texture. (Fig. 86.)

Generally, displacement of the fragments, in some degree, occurs with fracture; or subsequently by muscular action or the weight of the limb. Displacement may be transverse, oblique, longitudinal, angular, or rotatory, as compared with the axis of a long bone; or a depression, in the flat bones of the skull.

With fracture, the medullary web—endosteum—is torn, and completely across in most instances; the

periosteum is rarely much damaged. According to Mr. Paget's observations, the latter membrane is seldom stripped off the broken ends. Commonly, it is cleanly rent across at the same level as the fracture, and maintains its close union, having only its fibres somewhat frayed or pulled from their natural direction. Sometimes, it remains entire, even with extensive fracture; and in this case, thickening, it contributes to the security of the repair of the injury.

Any damage done to the surrounding soft textures, and the temporary extravasation of blood, are concomitants of fracture, not pertaining to the lesion itself.

*Signs.*—Fracture is attended with *mobility* of the broken portions of bone, and *cre-pitation*, a rough grating sensation, felt and heard, when the broken surfaces are gently moved in contact. Usually, the *normal outline of the limb* is altered, by the displacement of fracture and swelling, a disfigurement of *contour* which the experienced eye will frequently recognise at a glance; and there is more or less elevation or depression, also by the displacement and swelling at the *immediate seat of fracture*. (Fig. 87.) *Shortening of the limb*, in some degree, takes place when one of the long bones, as in either limb, is broken; and this resulting from the involuntary contraction of the muscles acting on the lower fragment, it takes place invariably, excepting under circumstances to be presently mentioned.

The direction in which the lower fragment is thus drawn, is upwards, and hence the shortening of the limb; but the displacement is determined by the linear action of the muscles; either in the resultant direction of their combined action in different lines, or in the direction of the stronger force of two antagonistic orders of muscles—the flexor muscles overcoming the extensors in either limb. Thus, in fracture of the humerus, betwixt its head and the insertion of the pectoralis major; this muscle chiefly, with the latissimus dorsi and teres major muscles, draws the lower portion of bone upwards, and inwards towards the thorax. With fracture of the femur in its middle third, the adductor muscles draw the lower portion upwards, and inwards behind the upper third of the femur; the approximation of the attachments of the adductors producing a certain fulness in the appearance of the upper part of the thigh, and which is more conspicuous by the shortening of the limb as compared with its fellow. When both bones of the leg are broken, the lower portions of the tibia and fibula are drawn upwards, and behind the upper fragments, by the action of the gastrocnemius and soleus as flexor muscles. Shortening of the forearm, in the opposite direction, may occur, but in a lesser degree, with fracture of the radius and ulna. Pain, and inability to use the limb, or broken bone, are *functional symp-*

FIG. 87.





toms of Fracture; but of equivocal value for an early and exact diagnosis. [P. p. 172.]

*Diagnosis.*—The pain may be insignificant at first, before swelling supervenes; and the power of motion be retained in the case of impacted fracture, or where one only of two companion bones is broken, the other acting as a splint. With fracture of the radius, in the forearm; or of the fibula, in the leg; the ulna or the tibia, thus preserves some of the motions of the limb; although the special functions of either bone may be lost. But if the functional symptoms of pain and loss of voluntary power, be well marked, they may each arise from other causes than fracture; as from dislocation, a bruise, or an attack of rheumatism, which thus far severally simulate fracture. The *physical* signs of Fracture may, *severally*, be *absent*. Mobility, in the case of impacted fracture; crepitation, if there be much displacement, or if soft tissue of any kind intervene between the fragments, or if some days have elapsed since the accident. The deformity of the limb, and the elevation or depression at the immediate seat of the injury, may be absent; as in impacted fracture, and in fracture without displacement; and these signs are less pronounced than usual, when one only of two companion bones is broken, the other resisting and supporting as a splint. Shortening also is absent in all such cases. The most difficult case is this; a fracture of one of two companion bones in the leg or forearm; and in a muscular subject, and when considerable swelling has supervened. There is no shortening and no angular deformity, no crepitation can be felt, and mobility of the broken portions is obscured by the swollen cushion of soft tissues surrounding the seat of fracture.

But if the signs of fracture be *present*, they may, *severally*, arise from other causes; with one exception—namely, mobility in the continuity of a bone. This can arise only from fracture. Crepitation may attend the play of the tendons in their sheaths, in connexion with inflammation; but the creaking, jerking crepitation thus produced, differs from the rough grating of broken bone. The altered contour of the limb, and of the part at the seat of supposed fracture, and the shortening of the limb; may arise, from a previous fracture, interstitial absorption, or other disease, of the bone, or from deformity, congenital or acquired, as rickets or mollities ossium. In the proximity of a joint, these signs may be due to dislocation; but the absence of crepitation, and of mobility, or the fact of immobility, are the turning points of the diagnosis.

It appears, then, that no physical sign taken singly, except one—mobility—is pathognomonic of fracture, and that any one sign may be absent; but all these signs taken *collectively*, determine the diagnosis. Functional symptoms, singly or combined, are insufficient; yet their concurrence further establishes the diagnosis.

*Causes, external and internal; and effects of Fracture.*—Fracture is produced, in general, by external force, suddenly applied, either to the part, or at a distance; but occasionally, it is the result of the sudden and powerful action of muscles, as in fracture of the patella, not unfrequently. *Predisposing* causes are numerous and very influential. Some relate to the functional uses of the bone; thus, the radius is liable to fracture in the manifold use of the hand; others are anatomical predisposing conditions, as the exposed position of a bone, the tibia for example; and brittleness of the osseous texture, as a condition consequent on age. Certain blood-diseases also apparently have some predisposing influence

in the production of fracture; rickets, syphilis, cancer, scrofula, and scurvy.

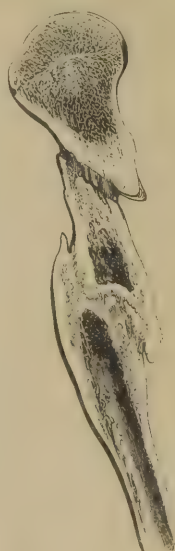
The lesion itself operates as an internal cause of constitutional disturbance, by producing shock in a greater or less degree, followed by reaction; or this may be accompanied by persistent shock, in the form of prostration with excitement; which is sometimes succeeded by Tetanus. [P. Ch. IX.] But simple fracture is essentially local in its effects, and does not necessarily cause any persistent constitutional disturbance.

*Repair.*—Fracture is disposed to unite by a modification of the process of primary adhesion, namely, by osseous consolidation of the bond of union; unaccompanied by inflammation, as follows:—*Inflammatory* lymph, in small quantity, is first exuded round about the seat of fracture, rendering the cellular texture more succulent, and thus producing a swelling, which, however, is partly or principally due to the blood extravasated by the injury. This mixed swelling gradually subsides; the exudation of lymph not continuing later in most cases, than the second or third day. A period of inactivity succeeds, of uncertain duration, but which, in the adult, is rarely less than one week or more than two. Then

FIG. 88.



FIG. 89.



the proper *reparative* or ossifying lymph begins to flow. A layer of this lymph is deposited between the fractured ends of bone, which, undergoing development into fibro-cellular tissue, or perchance into cartilage, and thence, in either case, into bone, restores the continuity of the fragments; forming an immediately connecting layer of bone—an “intermediate callus.” This is the *only* callus, whether the fragments be in even apposition (Fig. 88) or overlap. (Fig. 89.) The full sufficiency of an intermediate callus is beautifully illustrated in both the specimens figured; oblique fractures of the humerus—the one a fracture through the great tuberosity and part of the shaft (Museum Roy. Free Hosp.)—the other, a double fracture through the shaft (Sir A. Cooper). Neither an “external” nor an “internal” callus, therefore, is produced in the *human* subject, as was formerly supposed, excepting when the fractured limb or part is subjected to unusual motion during the process of repair, or when the original bone is diseased. Then, indeed, lymph-forming callus may be thrown out around the seat of fracture, ensheathing the fragments as with a bony clasp (Fig. 90), and formed also as a peg within the medullary canal. The lymph deposited in either of these situations speedily undergoes ossification. Around the bone, this process is chiefly or solely by outgrowth of

bone from either fractured end, and extending gradually towards the plane of the fracture, this part of the callus is last ossified. Within the medullary canal, ossification proceeds about the same time, consolidating

FIG. 90.



the cancellous tissue of the fragments, and at a later period uniting them. The walls remain still longer disunited. Either callus thus placed is formed *some time before* the intermediate lymph begins to ossify.

The new bone—wherever placed, between, around, or within—is true bone, and appears soon to acquire its proper microscopic characters. A new periosteum also is produced. At first firm, thin, and distinctly lamellar, it gradually acquires toughness and compactness of texture.

But the external and internal callus, when present, are *provisional* and *temporary*. They serve the purpose of two natural splints to retain the fractured ends in apposition while the intermediate callus is forming. When no longer requisite for this purpose, they are gradually withdrawn, the bone being fashioned off by absorption, and finally restored to nearly its original symmetry of outline. Little remains in after years to mark the scene of former injury, as if Nature, ever seeking to show her perfect work, were unwilling that any evidence of past imperfection should permanently remain on record.

Thus, then, by a modification of the reparative process of adhesion, as in an incised wound, a simple fracture is

FIG. 91.



reunited, and without regard to the particular direction of this lesion—transverse, oblique, or longitudinal—or the position of the fragments—in even apposition or overlaying; anatomical conditions or contingencies of minor consideration, pathologically and practically.

It is, indeed, most interesting to observe in corroboration of the provisional character of callus, externally and internally, that no such callus may be formed, even when the fragments are constantly subject to motion, as in *animals*. Fracture of the *furculum* or collar-bone in the common fowl, may thus unite, as shown by an appropriate and perhaps unique specimen in my possession (Fig. 91). Union of a fracture of the



thigh-bone in the same species of bird is also represented in the figure. Much thickening of the bone has occurred at the seat of fracture in this case, but no external callus, the sharp margin of the original fracture—an oblique one—being plainly seen at the line of junction by an intermediate callus, the only bond of union.

The *period* for the completion of fracture-union is uncertain. Various adverse conditions, of a persistent character, may severally tend to retard or arrest the formation of callus; thus illustrating the significance of persistent causes. [P. p. 706.] Causes predisposing to fracture, have this additional effect. Such, perhaps, are age, and certain blood-diseases—*e.g.*, rickets and mollities ossium, syphilis, cancer, scrofula, and scurvy. Other causes, not predisposing to fracture, have, perhaps, the same tendency to prevent union. Such are, febrile disturbance, erysipelas, starvation, pregnancy; and certain local conditions; as muscular action, frequent movement of a fractured limb, the direction of fracture as facilitating the recurrence of displacement, and the intervention of a piece of muscle, or dead bone, between the fragments.

The *Prognosis* of Fracture, as a lesion healing by a modification of the process of primary adhesion, is favourable. Otherwise, it will be determined by a due consideration of all those internal causes, which in their operation of retarding or arresting the formation of callus, thus perpetuates the injury.

*Treatment.*—Immediately after Fracture, the occasion for Surgical interference is urgent. The hard and rough portions of bone, subject to the action of muscles, or other movement, are apt to lacerate and bruise the surrounding textures. This state of the part is more provoked by fracture with displacement simultaneously, and when the broken ends of bone are pointed, as in oblique fracture. Hence arises increased and continued pain, spasm of the muscles, hæmorrhage and tension; or inflammation, advancing so far as to prevent the formation of reparative lymph at a subsequent period. Compound fracture may be produced, by either fragment piercing the skin. Shock also, which would have been slight and transient, is perpetuated. The rule of treatment as to time, was, and is still, I believe, with some Surgeons, to postpone any attempt to *set* the fracture at rest, until after the swelling itself—resulting from the injury—has subsided or been subdued by topical antiphlogistic measures. Some hours or even days, it is alleged,\* as a general rule, should be allowed to elapse for the realization of this purpose. The utter fallacy of this injunction, is obvious—the cause of increasing swelling still remaining in operation. Remembering, however, the period of inactivity, for a week or two, which succeeds the effusion of *inflammatory* lymph, in the first instance; the *final* adjustment of Fracture is unnecessary or useless, until about the termination of this period of non-reparation.

After Fracture, the subject of the accident should not be moved unnecessarily. If a lower limb be the seat of the fracture, it is important to wait until a suitable conveyance can be procured. A litter is best fitted to carry the person, without any jerking movement, which would inevitably damage still more the already injured soft parts. The condition of displacement with fracture, and the form of the latter, will render this consideration the more important. The production of compound fracture may thus be prevented. Hence, also, the limb should be

\* Chelius, by South.

properly secured, by tying it to its fellow, during the journey, however short, to an hospital or to home. The dress must be cautiously removed, and particularly from off the fractured limb, by ripping up the clothes.

The pathological analogy of simple Fracture to an incised Wound, as a solution of textural continuity; and the natural mode of healing in both these lesions, by a process of reparation essentially the same—namely, primary adhesion; at once suggests the two Rules of Treatment.

(1) *Reduction and Coaptation*, or the adjusted apposition of the fractured ends of bone. This condition implies a *suitable position* of the limb, to relax, as far as possible, any antagonistic muscles, which, by their spasmodic action, retain the fragments in a displaced position. It also implies some *extension* of the limb with *counter-extension* or passive resistance, sufficient only to bring the fractured ends of bone parallel, end to end; a procedure which is designated the “reduction” of Fracture. Coaptation or “setting” is then readily effected.

(2) *Maintenance of Coaptation*, during the process of reparation including the solidification of the callus. This still presupposes a suitable position to prevent re-displacement by the spasmodic action of any antagonistic muscles. But it also implies the employment of suitable retentive appliances, or *retentive apparatus*; and *both*, to ensure *rest*. This is, obviously, only the continued fulfilment, and completion, of the former rule of treatment.

Prior to the reduction of the fracture, it may be advisable to aid the vital powers in recovering from the shock of injury, by the administration of stimulants; wine, brandy, or ammonia.

Certain *exceptions* also to both the foregoing rules of treatment, are to be observed. Considering the purpose of reduction, it can be necessary only in cases of fracture, with displacement. Fracture without displacement, as when the lesion is transverse, and the ends of bone are broad and remain in contact, cannot require reduction. Such is sometimes the case in fracture of the lower part of the shaft of the femur. Then again, if one only of two companion bones, articulated together at either end, be broken, the remaining one renders any adjustment by extension and counter-extension, impossible. In fracture of the fibula, especially if high up, the tibia has this restraining effect. With fracture of the vertebræ, displacement cannot, and ought not to, be reduced. In *all* other cases, the reduction of Fracture is our first consideration in its Treatment. With displacement, angular, or rotatory, the kind of reduction is obvious. With shortening, extension and counter-extension are required.

*Reduction*.—The limb should be placed in a *suitable position*, not with the view of relaxing all the muscles, for that is impossible. No position can possibly relax “the whole set of muscles belonging to, or in connexion with, the broken bone;” as was recommended by Pott.\* On the other hand, the alleged unimportance of relaxing those muscles which resist the reduction, as taught by Desault, would be a serious error. The principle inculcated by Sharp and Pott, will ever guide the treatment of Fracture, in this respect. The limb should be *semi-flexed*, or, placed in that position which is natural to the part in a state of perfect repose. In sleep, the limbs are partly flexed, obviously, to relax the flexor muscles, which naturally overbalance the action of the extensors.

\* Works by Earle, 1790, vol. i. p. 364.

By this attitude of the limb, if complete reduction cannot be accomplished, in the first instance, the fracture may be partially reduced, and the ends of bone placed at rest; and thus in a position less hurtful to the surrounding soft textures. Indeed, in some cases, when the muscles which resist reduction, become relaxed, the ends of bone almost fall into easy apposition. They coapt, or adjust themselves into contact.

*Extension and counter-extension*, are necessary only, in so far as a suitable position is not of itself sufficient to effect reduction. So co-operative, however, is the relaxation of any resisting muscular action, that it has been, and, I believe, still continues, an open question with some Surgeons, to what *part* of the limb, the forces of extension and counter-extension should be applied? Boyer advocated the application of extension to the limb *below* the articulation with the lower fragment, and counter-extension *above* the articulation with the upper fragment. Thus, that in fracture of the leg, extension should be applied to the foot, while counter-extension fixes the thigh; in fracture of the thigh, extension should act on the leg, while counter-extension fixes the pelvis. For, it is alleged that were these opposite forces applied directly to the broken bone, the pressure of grasping the limb so near the fracture, would excite the muscles to spasmodic resistance. But the English School, has, ever since the time of Pott, urged the superior importance of flexing the limb; a position which necessitates the application of extension and counter-extension *directly*, to the broken bone; if in the leg, to the leg; if in the thigh, to the thigh.

The extending force, should not be forcible, but moderate, and moderated according to muscular resistance; equable, not jerking; and gradually increasing. Applied also, at first, in the direction of the lower fragment, the natural position of the bone is to be thus gradually regained, care being taken to restore the natural length and shape of the limb. Duly observing any deformity of the other limb, congenital or acquired; advantage may be taken of this opportunity to reduce the fractured limb to a corresponding condition, whether of length, shape, or both. Extension cannot prove effectual unless accompanied with counter-extension, equal, and opposite.

If the fracture be incomplete and the bone only bent, as happens sometimes in young children, reduction should not be accomplished all at once, but by degrees; each adjustment being secured by a suitable retentive appliance, placed so as to oppose the re-curving of the bone. In all other cases, reduction may be accomplished according to the directions just given.

*Coaptation* of the fractured ends of bone is effected by the act of reduction in some cases. Muscular resistance having been overcome by a proper position of the limb, the ends of bone readily come together; or they are easily adjusted by a little gentle manipulation. Any rough handling would further damage the soft textures round about the fracture. The ends of bone being brought parallel, their contact is announced by crepitation. This sensation and audible sign, also assures the Surgeon that no portion of soft-texture, as muscle, intervenes between the fragments; a condition which would impede or prevent their union. Adequate extension and counter-extension must, of course, be continued, during the application of any retentive measures; and in some cases subsequently, as will presently appear.

To maintain *Coaptation*—to retain the fractured ends of bone in



adjusted contact—position must still be observed for the relaxation of any antagonistic muscles which would cause re-displacement. Flexure of the limb, in various degrees, according to circumstances, is generally most suitable; especially in fracture near a joint, where ankylosis appears inevitable. Splints, of wood, pasteboard, leather, gutta-percha, or iron, and bandages; constitute the retentive appliances generally employed.

*Splints*, made of wood, are suitable in fractures of the lower extremities, where more strength of material is required; and the tin trough, or Liston's modification of McIntyre's splint is well adapted for fracture of the leg. Pasteboard, leather, or gutta-percha splints, are adapted for fractures of the upper extremities.

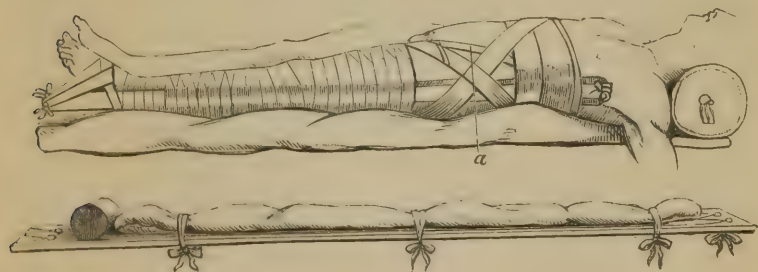
Splints are not always indispensable. In one or two fractures, coaptation can be maintained effectually by position and bandages alone; for example, fracture of the clavicle. *Two* companion splints are generally requisite, one on either side of the fractured limb. Each should be broad enough to cover and protect the whole depth of the limb, but not to double over it. If too narrow, or too broad, the bandage applied will either exercise undue pressure, or not support the unprotected soft textures, between the splints. In point of length, the splints should extend over and beyond the joint at either extremity of the broken bone; so as to fix it steadily, not by pressure on the seat of fracture, but by securing both these joints. With fracture of the thigh, the hip and knee; with fracture of the leg, the knee and ankle; are to be thus secured: "The true and proper use of splints," observes Pott, "is to preserve steadiness in the *whole* limb, without compressing the fracture at all." Hence the above rule of practice, and which he first inculcated. Splints should be comfortably *padded* with some light yielding material, as tow, or cotton-wool; and more particularly over prominences of bone, to prevent sloughing. Over the seat of fracture, any pressure is especially apt to peril the intervening soft textures, already damaged; while to forcibly subdue a *rising end* of bone by pressure, will surely induce sloughing, and rarely prove mechanically successful. Its replacement is best effected by removing the cause of such projection. Alteration of position, therefore, will be necessary to relax the muscles which are acting on the upper fragment, while the lower one should be adequately supported underneath. In certain fractures, this rising of either fragment is only apparent, and really due to the natural shape of the bone, as the arching forward of the clavicle; or, it may be an acquired deformity, as convexity of the tibia, from rickets.

The splints having been well adjusted, they are secured in position by a *bandage*, evenly applied round the limb from below upwards, and with just sufficient pressure for *this* purpose. No further restraint is required, excepting in the case of a maniac or a delirious person. If the fracture be subcutaneous, and either fragment threaten to protrude through the integuments; that portion of the limb may be left uncovered, or the splints lightly retained by a separate roller which can be readily removed without unbandaging the limb. No bandage need be applied *underneath* the splints, as was formerly practised, and is even now-a-days advocated by some Surgeons, with the view of preventing œdema. A bandage so placed becomes tense, as swelling inevitably ensues, and is thus apt to cause strangulation and gangrene. This result may, indeed, occur imperceptibly, and gangrene overspread the whole limb without any notable constitutional disturbance to arouse suspicion. Hence, also, in

applying the bandage around the splints, in the first instance, some degree of yielding should be allowed for the supervention of swelling, the splints being bound with sufficient firmness only to prevent displacement of the fracture. The *roller-bandage* is commonly used, and it is available where the limb can be moved without displacing the fracture. Rather than risk displacement, the *tailed-bandage* of Scultetus is a convenient substitute. It consists of a series of short strips of bandage laid transversely under the limb. Commencing below, each strip is drawn round the limb, so as to partially overlay and secure the next in succession. This contrivance forms an adequately firm bandage, like the common roller, extending uninterruptedly along the limb; but neither allow of tightening and relaxation, here and there, as occasion may require. The *looped-bandage* is specially adapted for this purpose, and without moving the limb. Double strips of bandage are placed transversely under the limb, at short intervals apart. One end of each is passed through the looped extremity, and being drawn sufficiently tight, is secured by tying it to the other free end. The splints are thus fixed by a series of ligatures, any one of which can be braced or loosened at pleasure, without altering the whole.

Extension must be maintained, in *some* cases, *after* the application of retentive appliances; and this, perhaps, cannot be accomplished without some *special* mechanical contrivance in the splints, or otherwise. In fracture of the femur, displacement is apt to recur. Desault's or Liston's long extending splint, with a straight position of the limb, overcomes any such tendency; extension being maintained by that portion of the bandage which passes round the foot-end of the splint, and counter-extension by a perineal band. This mode of treatment is here more advantageous than that of relaxing the muscles, by semi-flexing the limb and laying it on its outer side, as was proposed and practised by Pott. The general

FIG. 92.



principles of treatment in regard to the maintenance of coaptation by retentive appliances, may be illustrated by the treatment of fractured femur, as here represented. (Fig. 92.) Extension may be aided by a *weight* slung from the extremity of the limb; as from the foot, in fracture of the femur attended with unusual tendency to displacement. But a heavy weight is unnecessary; three, four, or five pounds weight, will suffice to tire the muscles and overcome their resistance. Extension is maintained, in certain instances of fracture, by means of an adjoining *bone*, used as a lever. In fractured clavicle, the humerus is utilized; an axillary pad being the fulcrum. Counter-extension is also secured, occa-

sionally, by means of an adjoining bone as the resting point. In fractured fibula, the head of the tibia is made the fixed point for Dupuytren's splint.

A suitable, yet simple, retentive apparatus, of splints and bandages, having been adjusted; the limb is rested and supported in a moderately *elevated position* to relieve any tendency to congestion, provided such elevation be compatible with that position whereby the muscles are most relaxed. In fractures of either lower extremity, where the patient remains in bed, a firm mattress is required to support the limb evenly and equably throughout its extent. If the fractured *part* be unsupported, it bends somewhat by its own weight, and displacement with eventual deformity will ensue. If either *end* of the limb be allowed to sink, there is the same tendency. Moreover, an *even* support to the whole limb, is the best safeguard against sloughing from undue pressure on any one point. The weight of bed-clothes, if tending to disturb the fracture, may be removed by a *cradle*. Spasmodic action of the muscles continues, in most cases, only for the first few days after the fracture has been set, during which period, therefore, displacement is most apt to recur; but, as the process of reparation scarcely begins before ten days or more—the “brooding-time” has elapsed, the *final* adjustment of any displacement is comparatively unimportant until *then*.

It is here, especially, in point of *time*, and subsequently, that the guidance of Pathology is superior to Empiricism, in regulating the interference requisite during the course of Fracture-union.

The reparative lymph forms a soft callus, fibro-cellular or cartilaginous, which remains *pliant* for some days or weeks; and, as proceeding from the living bone, it is self-constructive, and adapting in its supply; differing in all these provisions from the sudden and passive setting of any inorganic concrete or cement, and which is without increment, in any artificial mode of adhesion. During the process of reparation, therefore, the pathological Surgeon is ever watchful, never meddlesome, in his regard to the correct coaptation of the fragments, and the consequent length and shape of the limb. *Absolute* rest of the fractured part is not essential to union without displacement; and this suggestion of pathology regulates the degree of security requisite in any form of artificially retentive apparatus. Every *trivial* displacement, also, of the splints and bandages, need not be readjusted. If, however, the bandages slacken, they must be reapplied; if the retentive appliances get disarranged, they must be replaced. On the other hand, if pressure has become undue at any part, whether by swelling of the flesh, or setting of the padding, that part should forthwith be relieved; ever remembering that the Surgical purpose of any “retentive apparatus,” is not to fix the limb in a vice; but only so as by securing rest, to gain time for the injured part to itself undergo the process of reparation.

If, therefore, spasmodic muscular-action still recurs, from time to time, and threatens to frustrate the healing operation of Nature; the rebellious muscles should be coaxed if possible—not coerced—by any acceptable alteration of position; and quieted by the administration of sedative medicines, of which, opium and the tincture of digitalis, are, perhaps, the most antispasmodic. Tenotomy has been proposed, as a last resource, in the most obstinate cases; and division of the tendo-Achillis has been practised with success, in fractures of the leg.

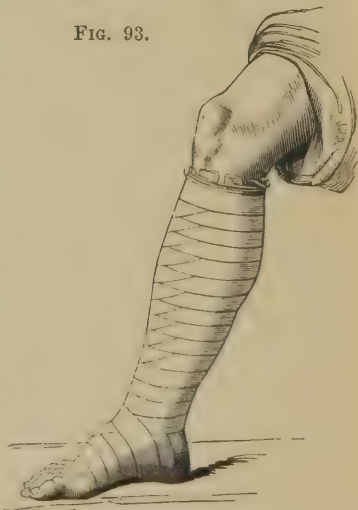
At length the proper time arrives, when splints and bandages may be



exchanged for an "immovable apparatus." When all chance of swelling has passed, spasm has ceased, and soft union is established, *then* only is the "starched" bandage *safe* and *advantageous*. At an earlier period, the unyielding nature of a solid casement, would not allow for *any* alteration whatever, in the size of the limb. As swelling inevitably supervenes, the immovable apparatus tightens, even to strangulation, and when the limb shrinks, it becomes as much loosened; thus entailing an almost daily entire reapplication of the apparatus, at that period of fracture. The unyielding nature of the starched bandage is offensive also to the muscles about the fracture, at a time when they are most irritable and susceptible of spasm. Professor Erichsen—I observe—advocates the use of a starched bandage at almost the *earliest* possible period after fracture, urging its safety and advantage, chiefly on these grounds; that it takes the shape of the limb "accurately and readily," and retains this shape by virtue of its "solidity."\* But these very characters of the starched bandage, are, in my opinion, the most obvious and valid objections to its application at that time. I am accustomed thus to fix the limb immovably, only when it no longer needs watchful supervision; and such apparently was Erichsen's rule of practice formerly.

The construction of the starched bandage, and other kinds of immovable apparatus, for fracture, should be well understood. By no means a recent invention; albumen and flour mixed, were used by Cowper, to stiffen fracture-bandages. Powdered chalk was preferred by Lawrence. Dextrine, by Velpeau. Gum arabic, with whiting, is the mixture recommended by Smee. Gum-shellac with glue, has also been employed. Plaster-of-Paris, by Mathiesen and Van der Loo of Holland; also by Kluge of Berlin, and Pirogoff of St. Petersburg. Starch was introduced by Baron Seutin, in 1834. A layer of cotton wool having been wrapped round the limb, and more thickly over bony prominences, short splints of softened pasteboard are adjusted around the seat of fracture; and, over all, a roller is applied in the ordinary manner, beginning from below upwards. A second roller is then applied, and the whole limb, thus encased, is smeared over with thick starch which is worked in with the hands. A third roller may be used, if necessary, as additional security. The casement formed, dries firmly in a day or two (Fig. 93). Plaster-of-Paris has only one mechanical advantage; it dries, and sets in a few minutes. This forms the most rigidly immovable apparatus, and is especially serviceable when the patient must undergo a journey. Supported by a starched bandage, the patient can move about at a much earlier period than otherwise; a great

FIG. 93.



\* Science and Art of Surgery.

advantage in relation to the general health, as compared with the prolonged confinement endured in the Treatment of Fracture formerly.

No *medicinal* treatment or scarcely any of a constitutional character is, usually, required in the course of simple Fracture. The shock of injury having passed off, the healing process goes on without apparently troubling the general functions of the body; and they, in turn, take little or no notice of the local process. If all the local circumstances of the part itself be conducive to healing, and the individual be in good constitutional health, at the time of the accident; it is then as natural for a fractured bone to heal and restore itself, as to maintain its own healthy integrity of structure by nutrition. Diet should be adapted to the altered hygienic condition of the individual, now disabled for business or pleasure; and, more particularly it should be proportioned to the wants of reparation. At first, therefore, moderate and comparatively innutritious, the diet must soon be more liberal and nutritious. Mild aperients, just to regulate the bowels, are needed not unfrequently, when the patient is confined to bed; but active purgatives are, by their action, apt to occasion disturbance of the fractured part, and so peril the process of union.

In due time—a period varying considerably according to the age and health of the individual—any retentive appliance may be *finally* removed with safety. The fracture must then be gently tried, to test its solidity, by passive motion of the limb. If firm union has taken place, the functions of the limb should be as tentatively resumed. In fracture of the lower extremity, this trial of power should be made *very* gradually; for if worked too soon, the limb shortens under the weight of the body, and permanent crippling is the result. Œdema, in some degree, is inevitable, when first the limb is allowed to be free and pendant. Gentle frictions will aid in restoring the circulation; and a lightly applied bandage gives support to the flesh, as yet flabby. Prolonged confinement, however, would tend to permanently waste and weaken the limb.

Thus—as in the management of an incised wound—the artificial support of a fracture is gradually withdrawn, and the limb allowed to resume its functions as gradually; until at length unaided Nature can stand alone.

**COMPOUND FRACTURE.**—*Structural Condition, and Diagnostic Characters.*—Compound Fracture is, essentially, Fracture, with a wound in the skin communicating; thus exposing the seat of fracture, however indirectly, to the action of the air. The structural disorganization, as regards the state of the bone, is the same as in simple fracture: but compound fracture is usually accompanied with more severe contusion or laceration of the surrounding soft textures. This condition, coupled with that of the aperture externally, which is also contused or lacerated; together form a Contused or Lacerated Wound, connected with, and around, a Fracture.

The *Signs* of this injury are the same as those of simple fracture, with the additional and distinctive character of an external irregular wound. Therefore, both the condition and characters are those of simple Fracture, *plus* those of contused or lacerated Wound.

*Causes, and Effects of Compound Fracture.*—Here again, the pathological history is that of simple fracture, with certain peculiarities superadded. External violence is generally the cause of the wound in the skin and subjacent soft parts, as well as of the connected fracture; which may then be regarded as produced by an extension of the injury from *without*.

Or, the fractured bone may itself penetrate to the surface and through the skin; the wound then being an extension of the injury from *within*. In the one case, the force is applied directly to the seat of fracture, and the injury is more a contusion; in the other case, the force is applied indirectly, to the bone at some distance off, and the injury is more a laceration, and less extensive. In both cases, the contused or lacerated textures are damaged beyond the apparent extent of injury; and the Shock to the nervous system is more severe than with simple fracture, owing to the greater damage to the soft parts, including nerves. Tetanus is, perhaps, more apt to supervene than after a contused or lacerated wound alone, and especially if the compound fracture be oblique, and movable among nerves and muscles [P. p. 441]. The textures injured, being in a state of disintegration, die, at least to some extent around; if the wound be allowed to remain open. This purely *traumatic* gangrene is the same as that caused by a contused or lacerated wound. Limited, therefore, to the part injured, and defined, eventually, by sloughing, or by a line of demarcation between the living and dead textures; the gangrene is immediate also, if the injury itself be severe.

*Course, and Termination.*—Inflammation supervenes, followed by suppuration, often profuse, and partial sloughing; or by gangrene, on a larger scale. Either degree of mortification, arising from inflammation, is limited to the seat of injury. By this process, however, a fracture which originally was simple, may become compound, in some cases. Ultimately, the tendency of compound fracture, when reduced, is to undergo reparation; union of the fragments taking place, either through the medium of fibrous texture, an imperfect support, or through a bony callus, with firm consolidation. Ununited fracture, and false-joint, will be hereafter considered. The wound in the soft textures closes up and heals by suppurative granulation and cicatrization. *Spreading* gangrene—due to some morbid condition of the blood—supervenes on compound fracture, only as an occasional contingency; and its phenomena have been already described in connexion with the course of contused and lacerated wounds.

The *Prognosis* of Compound Fracture, as gathered from a due consideration of the natural course and tendency of this lesion, is far less favourable than that of simple Fracture. An *open* wound, communicating with the seat of fracture, as compared with subcutaneous laceration of the soft parts, is one unfavourable ground of prognostic distinction. Scarcely less so, is the *greater extent* of their laceration, usually in compound Fracture; especially if produced by direct violence. [P. p. 723.] *Spreading* gangrene is an adventitious condition, yet a most unfavourable one, as implying the co-operation of a constitutional cause. [P. p. 737.]

*Treatment.*—The same rules of treatment are applicable as for simple fracture; but, certain particulars, having reference to the special pathology of compound fracture, are peculiar to its treatment.

*Reduction* of the displacement may present special difficulties. Thus, if one or both ends of bone *protrude*; whether this condition has arisen passively, simply by the original force of the fracture; or subsequently, by the sheer weight and position of the limb, or possibly by rough handling—the displacement can be reduced by sufficient extension of the limb. When, however, such displacement is due rather to muscular contraction and spasm, acting especially on the lower fragment which is thus drawn upward; enlargement of the wound, by incision, is preferable to forcible extension; and this proceeding is the more urgent also, in



proportion to the circumferential swelling, from hæmorrhage or serous effusion. With increasing tension, the protruded portion of bone becomes tightly embraced by the aperture in the integuments, through which it has passed; a condition not unfrequently witnessed in compound fracture of the tibia, and which obviously suggests the propriety of enlarging the aperture to free the bone. An exceptional case sometimes occurs; when protrusion arises from *deformity* of the bone, as in rickets. Excision of a portion of the bone may then be necessary to reduce the displacement. Union, firm and permanent union, will probably take place; with or without, the reproduction of new bone as an intermediate callus. The limb, accordingly, is ultimately restored to its original length, or remains proportionately shorter than its fellow. In one such case, where the tibia was arched forward, in consequence of rickets, I removed two inches of that bone, an inch from either fractured end; and the result was highly satisfactory. [P. p. 773.] *Splinters* of bone have special significance in relation to the treatment of compound fracture, there being an open wound communicating. If only partially detached, any such portion of bone may retain its vitality and regain its connexion. But if completely detached, the fragment is obviously a foreign body, and should be removed accordingly; a proceeding the more imperative, when any such fragment intervenes between the fractured ends of bone; thus opposing their reduction and intercepting their subsequent apposition, and the process of reparative union. In any case, where a considerable portion of bone is removed, in compound fracture, whether owing to protrusion, deformity, or splintering; care should be taken, in maintaining reduction, that the interval between the ends of bone be not equal to the portion removed; lest, an inadequate length of callus being produced, imperfect union should be the result.

*The Wound.*—Reduction-difficulties having been overcome, and the limb retained in position by suitable splints, well padded and protected by oiled silk from the soaking of any discharge issuing from the wound; then comes the treatment peculiar to *compound* fracture—the treatment of the wound, and state of the soft parts involved. The *primary* indication is to close the wound, with the view of soliciting its union by adhesion, and thus convert the fracture into a simple one. For this purpose, a pad of lint, soaked in blood from the wound, as formerly practised, or better, simply wet lint, or soaked in carbolic-acid solution, should be applied over and around the wound, so as entirely to exclude the air.

Considering the great difference, in safety and time, between primary adhesion and the process of suppurative granulation; assuredly the former mode of reparation should be first solicited in *all* cases. In some compound fractures, with comparatively little laceration of the soft textures and of the aperture externally, as when produced indirectly, by protrusion of the bone; the wound being closed and protected from the air, heals by adhesion in a few days, and the subsequent progress of the case is that of simple Fracture. In other cases, with confusion of the wound and sub-jacent textures, this mode of healing may be *tried*, in the *first* instance; but abandoned immediately effusion and tension supervene in any such degree as clearly indicates the necessity for a free discharge of clots, and of matter during the course of suppuration. *Early* solicitation of primary adhesion, and *timely* abandonment of the attempt, in favour of suppuration, as soon as this event occurs or is inevitable; constitute a compromise, which overrules any objection as to the *probable* failure of the one

and the supervention of the other. If the attempt prove successful, the advantage is gained of then having to deal with only a *simple* Fracture.

*Suppuration*, or *Gangrene*, having supervened, the treatment should respond to these consequences of Inflammation. Firstly, as regards *local* measures. With progressive suppuration, pus may be diffused and accumulate, without much if any tendency to point; then, *early*, *free*, and *dependent incisions* are necessary, for the easy vent of matter as it forms, and to relieve tension. Otherwise, the pent-up matter, working its way about the seat of fracture and among the textures around, dissects and detaches the bone, periosteum, muscles, nerves, and vessels; and thus destroying their continuity, the fracture remains ununited, and the parts around become saturated and soddened; in short, an irreparably disorganized limb is the result. Consequently, at a later period, incision may be necessary to remove any portion of dead bone, whether as an *exfoliation* or a *sequestrum*. Compresses of lint, properly applied, will do much to prevent the burrowing of matter; and the pad of wet lint, or lint soaked in blood, which closed the wound in the first instance, may now be advantageously exchanged for a poultice, or piece of wet spongopiline, as a cleaner application, to promote the discharge, for a time. But this should be succeeded by light water-dressing, or with carbolic acid solution, when the continuance of warmth with moisture would only sodden and relax, and when the wound is granulating. The same rule holds good whatever number of incisions may have been made; the spongopiline, and subsequently, water-dressings, varying according to the requirements of the case. Secondly, as regards *hygienic* and *medical* treatment for the constitutional disturbances consequent on Suppuration and Gangrene, respectively. Pathology, at present, guides less than experience in this direction. The interpretation of hectic, and of gangrenous typhoid fever, is considered under Inflammation, p. 55, and Gangrene, p. 149.

*Hectic fever* and exhaustion, consequent on prolonged and per chance profuse suppurative discharge, are best relieved by a diet, consisting principally of animal food, in which albuminoid matters prevail, with wine, beer, or spirits, according to the patient's previous habits. In short, what is termed a nourishing and stimulating diet, is most efficacious; the quantity of food being regulated by the digestive power of the individual, and the stimulants proportionate to his previous habits and present exhaustion. Tonics, in the shape of quinine and the diluted nitro-muriatic acid, or other mineral acid; are to be regarded only as serviceable adjuncts. Sleep must be procured by an opiate nightly, when necessary; and restlessness allayed by maintaining the influence of opium, slightly, day by day, until the strength is somewhat restored. Careful regulation of the alvine evacuations is a most important injunction throughout the course of hectic fever; any approach to constipation increasing the general irritability. It may, however, often become necessary to check, if possible, the tendency eventually to diarrhœa. The hygienic and medical treatment for the *typhoid fever* arising from gangrene or sloughing, is substantially the same as that for hectic fever. But this also will be more properly resumed with the general pathology of Gangrene.

The foregoing rules of treatment presuppose the preservation of the limb, in compound fracture, as well as the obvious indication of preserving life.

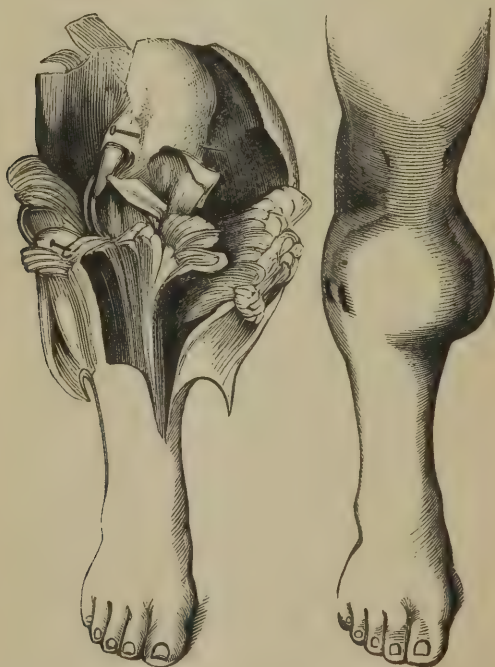
*Amputation.*—The question of amputation, depends upon the super-

vention of profuse suppuration with perhaps necrosis, or of traumatic gangrene; in either way, the limb is *irreparably* disorganized, and life thereby endangered.

1. When the *whole substance* of a limb is involved by the injury of compound fracture, either or both results are *inevitable*; and there is no alternative but *primary*, or immediate, amputation.

Such was the condition in a case of *compound and comminuted fracture* of the *tibia*, just below the anterior tubercle, with *fracture* of the *fibula*, one inch below the head of that bone (Fig. 94, showing appearances on removal of integuments). But there was also (as represented) extensive *laceration* of the *muscles*, particularly of the *tibialis anticus* muscle, which was torn across and thrown inwards over the *tibia*; the *anterior tibial artery* was torn through (as indicated by the lower pin in the figure), but the corresponding nerve and the *musculo-cutaneous nerve* (seen above) were entire. Here, then, in addition to the worst kind of fracture of

FIG. 94.



both bones, the conditions were present of inevitably profuse suppuration, by extensive laceration of the muscles, and of impending gangrene, by rupture of the anterior main artery. This injury was caused by contusion of the leg between a brewer's dray and a post, and I may add, therefore, another lesion had occurred—*extensive detachment* of the *skin* from the deep fascia of the limb, the superficial, cellular, or subcutaneous fascia being infiltrated with blood. It corresponded to the large sheath of integument thrown back in the figure. This condition I have found also



in the dissection of many other limbs severely injured by direct violence. It may be present without any wound in the skin, or discoloration at first, and it may exist far beyond the apparent seat of injury, thus misleading as to the *part* proper for amputation. The characteristic external appearance of this *typical* example of bad compound fracture is represented in the adjoining figure of the limb, as seen within a quarter of an hour after the accident. The swelling, of considerable size, corresponded to the lacerated and blood-engorged extensor muscles, and their displacement inwards over the tibia. Four apertures in the skin, the two upper communicating directly with the fracture, complete the picture.

2. When, however, the extent of damage is itself *partial*, the supervention of profuse suppuration or gangrene is but *proportionately probable*; the limb is *not* inevitably lost, nor the life surely perilled. Accordingly, the postponement of amputation until the *actual supervention* of either or both these local conditions, in other words, *secondary* amputation, should be the rule observed, in order to give the limb *its* chance of preservation; the safety of life being provided for, by *timely* amputation, under these circumstances.

The question of amputation, and as primarily or secondarily, is determined by these two pathological considerations.

Certain rules, however, as to the urgency of amputation are laid down in surgical works, according to the *extent* of injury to the vessels, nerves, &c. Any such pathologico-anatomical conditions have significance, only in proportion to the certainty or probability of profuse suppuration or gangrene supervening. But observations of the course and tendency of compound fracture, in different doubtful cases, have not hitherto been sufficiently accurate and ample, to establish any such absolute rules of practice with respect to amputation; and less so when the necessarily unknown capabilities of the reparative power in different individuals, are also taken into account. No Surgeon can positively determine whether amputation should be performed in a doubtful case; guided by this or that extent of injury, and in this or that individual. Misled by *à priori* considerations suggested by the pathologico-anatomical conditions of compound fracture, clinical observation is precluded; and thus many limbs are probably sacrificed surgically, which otherwise might be saved, if the treatment were determined by watching the actual course and tendency of the case; in other words, by observing the pathology of the particular form of injury, and as subject to the reparative power of the individual. Not one of the conditions of compound fracture, alluded to, are found to be invariably followed by profuse suppuration or gangrene; not one of the considerations commonly urged in surgical works, as to the necessity for primary amputation, are infallible. If then, *exceptional* cases are discovered by the advancing study of pathology; in how many more cases, might limbs, hitherto sacrificed surgically, have been saved, and be preserved in future?

With such qualifications, the following forms of compound fracture may be condemned to primary amputation:—

(1) Fractures, in which the wound is the consequence of the violence that breaks the bone, and in which there is *much laceration of, and extravasation into, the soft parts*; more particularly if the integuments be stripped off, portions of the muscular bellies protrude, and the planes of cellular tissue between the great muscles of the limb be torn up and infiltrated with blood. Injuries of this description occurring in the *lower*

extremity always require amputation. The danger to the patient increases not only in proportion to the amount of comminution of the bones and of injury to the soft parts, but also in the exact ratio of the *proximity* of the injury to the *trunk*. Thus, amputation of the thigh for bad compound fracture of the leg, though a very serious operation, is sufficiently successful; but when the femur itself is badly fractured and amputation of the thigh high up is required, recovery can indeed but seldom be expected. A bad compound fracture of the thigh, high up, may almost be looked upon as a fatal accident. In the arm, such accidents are not so serious, and admit of the member being saved, unless the bones be greatly comminuted.

(2) When one of the *larger arteries of the limb has been wounded* by the violence that occasions the fracture, or has been lacerated by the broken bone itself, there may be copious arterial hæmorrhage externally, as well as extravasation into the general cellular tissue of the limb. These cases most commonly require immediate amputation; care being taken, that hæmorrhage be temporarily arrested by the application of a tourniquet to the main artery, and an elevated position of the limb.

(3) *Comminution or splintering* of the broken bone, with compound fracture of the femur, may generally be regarded as a case for immediate amputation; except when occurring in the upper third, which is generally fatal; or when the comminution is trivial, the splinters large, lying in the axis of the bone, and the subject young—favourable circumstances which render amputation unnecessary. In the arm, forearm, and hand, and in the leg, provided the knee or ankle-joint be not involved, much may be done in the way of removing splinters of detached bone, and in sawing off smoothly the rugged ends of the fixed fragments.

It is a question for further observation to determine, how far *excision* may surpass amputation in all *localized* complications of compound fracture.

(4) *Wound of a large joint*, with compound fracture, more especially if there be crushing or splintering of the bones which enter into its formation, with extensive laceration of the soft parts, is one of the most serious injuries that can be inflicted on a limb; and, when occurring in the *lower* extremity, it may be looked upon as a case for amputation—unless it be the hip-joint that is so damaged, when there will generally be so much injury inflicted on the pelvic bones and their contained viscera, as to preclude the performance of any operation. When the elbow or the shoulder-joint is the seat of compound comminuted fracture, with extensive injury of the soft parts, and possibly laceration of contiguous nerves or large blood-vessels, the case is one for immediate amputation. But, if the injury be localized to the bones, the soft parts being in a favourable state, *excision* of the articulation may advantageously be practised.

(5) *A simple fracture high up, with a bad compound fracture low down in a limb*, is a complication affecting the *part* to be chosen for amputation. This will depend on the condition of the soft parts *between* the two injuries. If sufficiently sound for healthy flaps, that part should be selected; if otherwise, the part immediately above the simple fracture must be the seat of amputation.

(6) *A dislocation high up, with a bad compound fracture low down*, is a similar complication as to the *part* for amputation. If a simple dislocation, it should be reduced, and amputation then performed as low down as may be compatible with sound flaps, above the compound frac-

ture. If the dislocation be compound, amputation at, or above, that joint is unavoidable.

*Spreading* traumatic gangrene, arising from compound fracture, has the same relation to amputation, as in the case of contused or lacerated wound. The rule of treatment should be; removal of the exciting cause by amputation of the limb, without delay, and at some height above the seat of fracture—no line of demarcation forming in spreading gangrene, to indicate the time and part for amputation.

COMPLICATED FRACTURE.—These injuries follow naturally in the order of description after compound Fracture, which is a complication relatively to the simple form of this injury. But the complications here referred to are *any additional* injury or injuries which may be received simultaneously with Fracture, whether itself simple or compound; and *any morbid condition*, local or constitutional, which may be connected with either lesion as predisposing to its recurrence, or as affecting the process of its repair. Any such additional injury or morbid state complicates the whole pathology of Fracture, enlarging the consideration of its structural conditions, and diagnostic characters; internal causes, course, and results. The pathological indications of treatment are more numerous, accordingly.

Fracture may be complicated by association with *injury* to a *large artery* or *nerve*, by extensive laceration of the *muscles*, by extending into a *joint*, or by an accompanying *dislocation*. It may be associated also with injury to some special part or *internal organ*; as fracture of the pelvis implicating the bladder, of the ribs wounding the lung or pericardium, or of the skull injuring the brain. Then again, Fracture may be complicated by association with some *morbid condition*, local or constitutional. Thus, certain blood-diseases predispose to fracture, and retard or arrest the formation of callus. Rickets, syphilis,\* cancer,† scrofula, and scurvy, have severally this twofold effect; while febrile disturbance, erysipelas, starvation,‡ and perhaps pregnancy,§ severally tend to prevent union. Opinions are, however, divided, respecting the preventive influence of, at least, some of these conditions; and the references given will afford further information.

Some of the foregoing complications of Fracture may be regarded as combinations of other forms of *injury* therewith, and which have been *already* considered, in connexion with compound fracture; as injury of a large blood-vessel with fracture, fracture with dislocation, &c.; others pertain to *special* pathology—*e.g.*, injury of the brain, or other internal organ, with fracture.

Of *morbid* conditions; the local are but *manifestations* of the constitutional—*i.e.*, of the blood-diseases, to which I have just adverted; and these will be considered in relation to Ununited Fracture.

*Treatment*.—Two pathological considerations are of general practical importance and applicability. 1stly. Is the complication any *morbid condition* or *conditions* in operation, locally or constitutionally; which, as internal causes predisposing to Fracture, perpetuate the injury—whether

\* Dict. de Méd. et Chir. Prat., iii. p. 492; Journ. de Méd. Chir. et Pharm., t. xxv. p. 216; Exposé des Symp. de la Mal. Vén. p. 525; Oppenheim on False Joints, 1837.

† New York Journ. Med., 1852, July, p. 97.

‡ American Journ. Med. Sciences, Jan. 1842. Monograph by G. W. Norris.

§ Ibid. See also this monograph for complete information and references on all other causes of "Non-Union after Fracture."



simple or compound—or retard the natural process of repair? In this case, the treatment must be entirely subject to such one or more *causative* conditions. 2ndly. Is the complication any *injury* or *injuries*, *additional* to Fracture? In this case, the treatment of the *fracture* may be of entirely subordinate importance, even although it be, as in many such cases, severely Compound.

**DISEASED CALLUS, AND DEFORMED UNION.**—These conditions represent the unfavourable terminations of United Fracture.

The whole pathology of Diseased Callus is that of Diseases of Bone in general; but they may severally be associated with Deformed Union after Fracture.

**Structural Conditions.**—Deformed Union of Fracture appears in various shapes, according to the relative position of the fragments. (a)

FIG. 95.



Union with displacement; angular, rotatory, transverse, or lateral, with overlapping of the fragments, and oblique or longitudinal displacements. (Fig. 95.) (b) Union of two adjoining parallel bones, as the radius and ulna, the tibia and fibula, or two adjacent ribs.

**Diagnostic Signs.**—These various conditions of deformed union present obviously characteristic appearances; but they resemble the appearances produced by corresponding displacements in Fracture, without union. Absence of mobility will always be distinctive of deformed union.

**Causes, and Effects of Deformity.**

—The *external* causes of deformed union after Fracture, may be any circumstances which occasion displacement of the fragments. Thus, unsuitable retentive appliances, or their unsuitable application, will have this effect; so also, rough-handling of the part, during the process of repair.

*Internal* causes comprise; muscular action displacing the fragments; and *diseased* conditions of the callus; as exuberant callus, resulting from inflammation affecting it during, or after, its formation.

The *effects* of deformed union of Fracture, are *mechanical*. If occurring in the neighbourhood of a joint, its action will be impaired. If in the shaft of a long bone, as the femur, ineffectual power is experienced, and in various ways, according to the direction of displacement. Thus, shortening of the limb occasions lameness. If two companion bones are conjoined, serious loss of function may be the result; as loss of pronation and supination of the forearm by union of the radius and ulna. Or such union may be unimportant; as in the case of the tibia and fibula.

**Terminations.**—In respect to the process of union, the vital history of deformed-union presents nothing peculiar. The recognition of two stages

in the process is, however, of practical importance; recent or *incomplete* ossification of the callus, and old-standing or *complete* union.

*Treatment.*—(a) *Recent* union, with displacement, suggests the propriety of endeavouring to rectify the deformity *gradually*. *Extension* and compression may be applied; either by manipulation, from time to time, and the interim application of a suitable retentive apparatus, or by means of some contrivance to slowly reduce the displacement. Either should be worn as long as occasion requires; say, from 3 to 5 weeks. Successful results have been obtained in numerous fractures after union of some duration; as 25, 29, 59 days; and possibly, after 4 or 5 months. In the event of a *more* unyielding callus, although still of recent formation; *refracture* becomes necessary, but this must still be done gradually. It may be accomplished, in like manner—by manipulation, or by the application of a screw-press; in either way, the object being, to break the callus, under the influence of chloroform, and to reset the bone in its natural axis and position. The extreme period of union when this procedure can be safely resorted to, is determined principally, by the *degree* of consolidation which may have taken place. *Experience* has sanctioned different periods of limitation. Thus, the 24th week, is the extreme limit advisable, according to Osterlen. A little longer was conceded by Bosch, perhaps 6 or 6½ months. Mr. Skey, however, in one case refractured the leg of a boy, æt. fifteen, 13 months after the original fracture.

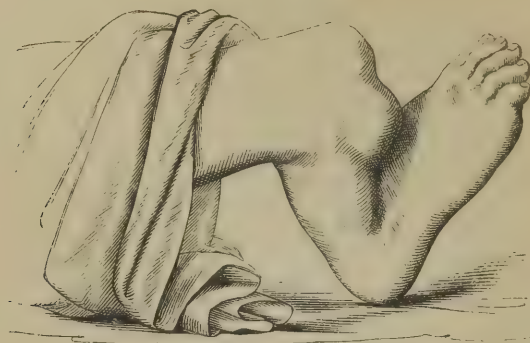
(b) *Complete* osseous-union, can only be overcome by a *cutting* operation. The callus having been laid bare, it may be *divided*—the operation of *section*—by a small saw or bone-forceps; or *excision* of the callus may be necessary, particularly if it be exuberant. The ends of bone are then to be readjusted aright, and the case treated as compound fracture. But the very fact of this condition resulting from the operation, coupled with the inherent peril of the operation itself; render it one not lightly to be entertained. To say that by an incision the callus is reached, does not convey a true idea of the operative difficulties subsequently experienced, owing to various *pathological* conditions of the callus, and of the parts around.

For the inter-union of two *contiguous* bones, accompanied with serious loss of functional utility, as pronation and supination in the forearm; division of the callus is more imperatively necessary, if refracture cannot be accomplished. But with union of the tibia and fibula, either, and indeed any operative proceeding is generally unimportant; and as regards the junction of two ribs, is obviously impracticable.

UNUNITED FRACTURE, AND FALSE-JOINT.—DISUNITED FRACTURE.—*Structural Conditions.*—Four varieties of Ununited Fracture are recognised; two of which may be regarded as stages of non-union, and two, of false-joint; in either case, proceeding from incomplete to complete. They thus form a continued series of structural conditions, from imperfect union to perfect articulation. (a) The fractured ends of a bone may be united by an ensheathing *cartilaginous* callus; which, however, fails to undergo ossification. This condition is known by partial mobility of the part when handled, and the limb is proportionately useless. (b) *Total* non-union may occur, there being no kind of connecting medium between the fractured ends, which are also apparently diminished in size. They are freely moveable, and the limb altogether useless and wasted. (c) Most commonly; in both fragments, the medullary canal is obliterated, the ends are rounded and pointed by absorption, and covered in by the for-

mation of a tissue resembling periosteum; they are connected together by a strong *ligamentous band* or by several narrow bands, firmly attached to the bones. This new material is very pliable, and the *incomplete joint* thus constructed is moveable proportionately to the length and laxity of

FIG. 96.



such ligamentous connexion. (Fig. 96.) The internal condition is shown in Fig. 97. (d) Lastly, and rarely, a dense *capsular ligament* may be formed, and contain a fluid like synovia; the ends of bone have become smooth and polished, possibly eburnated, or covered with points,

FIG. 97.



possibly thin plates, of cartilage, and a synovial membrane similar to that of a natural articulation. Thus then a *complete false-joint* is constructed. The fractured ends, instead of being partially consolidated, as in the first condition, are freely moveable; but they have not the *useless* mobility of total non-union, nor the irregular action allowed by a loose band or bands of ligament with intervals between them and which less entirely surround the ends of bone. They are retained *in situ* by a dense and complete capsule, and cannot be displaced unless subjected to considerable force. The limb is proportionately *useful*. Certain authorities, such as Chelius\* and Hewson, supporting the assertion originally made by Boyer, have disputed the existence of this complete condition of false-joint. Several authentic cases are, however, recorded by Norris. Key† saw an instance in the spinous process of a vertebra; Brodie‡ in a rib; Kuhnholz,§ in the femur; Home,|| Cruveilhier, and Howship,¶ in the humerus; and

\* Malad. Chirurg. t. iii. p. 103, 1831; North Amer. Med. and Surg. Journ., No. ix. p. 7, 1828; Traité de Chir., trad. par Pigné, p. 150, 1836.

† Sir A. Cooper on Fractures, &c., 1842, p. 532.

‡ Lond. Med. Gaz., 1833, xiii. p. 57. § Journ. Complément. t. iii. p. 239.

|| Trans. of Soc. for Imp. of Med. and Chir. Knowledge, 1798, p. 235.

¶ Med.-Chir. Trans., viii., 1817, p. 517.



Langenbeck, Houston,\* Sylvestre,† and Bécarrd.‡ have made similar observations. Those of Otto§ are further testimony. Breschet|| readily produced complete false-joint, in his experiments on *animals*, in which it seems to be the most common form of union.

*Causes, and Effects of Ununited Fracture.*—The *external* causes of non-union after Fracture, may be any circumstances which occasion motion of the fragments, beyond that degree which is compatible with the formation of callus and its ossific consolidation. Unsuitable retentive appliances will have this effect, or their unsuitable application; so also, handling the part daily or even more than occasionally, during the process of repair. Hence, the practice sometimes witnessed, of frequently readjusting the limb, is as obnoxious as that which formerly prevailed, of close imprisonment and unalterably fixed position. *Internal* causes comprise; *muscular action* separating the fragments and thereby preventing union, as in fracture of the patella, and in that of the olecranon; or the interposition of any *foreign body*, whereby union may be intercepted. A portion of muscle, tendon, or a clot of blood intervening, is thus obstructive; of which two instances, by a piece of muscle, were seen by Mr. S. Cooper. A fractured clavicle, however, has been known to unite by two pieces of bone which enclosed an ossified subclavius muscle. (Bérard.) A piece of dead bone, in another case, retarded the process of repair for eight months; when the sequestrum being removed, union ensued in three or four weeks. (Schmucker.) Other local internal causes—not acting mechanically as impediments to union—pertain to the function of *nutrition*, at the seat of fracture. They are, chiefly, any obstruction to the circulation, producing local anæmia; as by early, tight, or prolonged bandaging, or by an immovable apparatus; wet, and especially refrigerant applications; or, on the other hand, inflammation, an abscess, or ulcer; paralysis, or any occasion of pressure on the nerves distributed to the seat of fracture; and lastly, disease of the bone itself. But the latter causative condition is not unfrequently a local manifestation of some blood-disease as a constitutional cause, and affecting the *quality* of the blood supplied to the part.

The influence of *blood-diseases* in preventing or retarding the formation of callus, has already been noticed among the complications of Fracture. The diseases alluded to are, chiefly, rickets, syphilis, cancer, scrofula, scurvy, fever, erysipelas; and the conditions of blood consequent on starvation and pregnancy. But opinions are, as I have said, divided respecting the alleged mal-influence of these diseases. The same adverse character is attributed also to habitual intemperance, copious hæmorrhage, or other discharges; and, in short, whatever induces general enervation of the vascular and nervous systems with failure of nutrition. That one or more of such causes may be in operation, and co-operate, without preventing or retarding the process of osseous union and firm consolidation, is certain. A remarkable case in point, of fracture of the tibia, was under my care in the Hospital. [P. p. 773.]

The *effects* of ununited fracture are entirely local and mechanical, by impairing the action of the muscles and the use of the part. The limb

\* Dublin Med. Journ., viii. p. 493.

† Nouvelles de la Répub. des Lettres de Bayle, 1685, p. 718.

‡ Anat. Gén., trans. by Hayward, pp. 149, 248.

§ Path. Anat., trans. by South, i. p. 138.

|| Recher. sur la Form. du Cal., 1819, p. 34.

becomes wasted, powerless, and useless; and the more so as non-union is complete and permanent.

*Terminations.*—Ununited Fracture frequently proceeds to a natural cure. In case (*a*), this takes place by *ossification* of the cartilaginous callus, already formed, which then becomes an instance merely of retarded or delayed union. The line of distinction between *arrest* and *delay*, in the transformation of a cartilaginous into an ossific callus, is imperceptible, and therefore doubtful, in all cases. Experience shows, that not until after four, six, or even eight months have elapsed, is firm union by unaided Nature, eventually improbable. In case (*b*)—that of total non-union—the process of natural cure supervenes by the formation of an uniting medium, and its ossific consolidation.

But, Ununited Fracture may remain in a *stationary* condition; the process of union being arrested, in either of the cases, (*a*) or (*b*). Lastly, the Fracture may become *more moveable* by the formation of a false-joint; incompletely (*c*), or completely (*d*), as a diarthrodial false-joint.

In estimating the probability of either of the latter issues; statistical results are at least trustworthy to show the comparative infrequency of non-union, in *any* form, as the *final* issue of Fracture.

The results collated in Hamilton's elaborate work,\* afford a sufficient body of evidence on this question. Amesbury alone seems to have believed in the frequency of non-union. His experience extended to 90 cases. But, Walker, of Oxford, affirms that of not less than 1000 fractures which came under his treatment at some period of the repair, he does not recollect more than 6 or 8 instances. According to Lonsdale, not more than 5 or 6 cases of false-joint, excepting those within a capsule, have occurred out of nearly 4000 fractures treated at the Middlesex Hospital. In a table of 367 cases, collected and arranged by Mr. W. Morland from the books of the Massachusetts General Hospital, extending through a period of nineteen years, only one instance of false-joint is recorded; and as only seventy-four days had elapsed when this patient was discharged, it is doubtful whether this might not have proved to be a case of delayed union simply.† Of 946 cases of recent fracture in the Pennsylvania Hospital, between the years 1830 and 1840, no instance of false union followed the treatment pursued.‡ Sir Stephen Hanmick, Liston, and Malgaigne, bear testimony also to the infrequency of these accidents in the cases which have come under their care. Hamilton has seen a considerable number of examples of non-union, but in not one of his own cases, whether in Hospital or private practice, has the bone refused finally to unite; and his opinion is, that, in proportion to the total number of fractures which occur, such cases are very rare, perhaps not more than 1 in 500. In my own experience, I may add, 5 cases only have come under my observation or treatment; as compared with many hundreds of fractures, during a period of more than twenty years. Two were fractures of the humerus, at the junction of the middle and upper third; and two were fractures of the femur; one at about the junction of the middle and lower third, and the other at the junction of the middle and upper third. The particulars of the latter case—which occurred when I was a student, at University College Hospital—are narrated in my *Principles of Surgery*, p. 711. Lastly, a compound and comminuted

\* *Fractures and Dislocations*, 1860, Philadelphia, p. 68.

† Address on Fractures, A. L. Peirson, May 1840.

‡ Norris, *Op. cit.*

fracture of the tibia, about the middle of the shaft, was followed by the separation of portions of dead bone and incomplete or cartilaginous union.

*Treatment.—Earliest occasion for interference.*—Guided by the natural course and tendency of Ununited Fracture; not until the lapse of 4, 6, or even 8 months, is the Surgeon justified in concluding that union will not take place. During, however, the latter portion of this period, and even before the expiration of the first-named period, 4 months, he will begin to *suspect the improbability* of union ensuing; this improbability increasing according to the lapse of time, without the process of repair supervening, or adequately progressing. Consequently, the earliest occasion, or period for interference, is some months *before* the fracture assumes the condition of false-joint.

*Indications of Treatment.*—Taking the structural conditions in the order already mentioned; the indications of treatment have reference primarily to non-union, in each of the two states described.

(a) With *incomplete* union, the general indication of *local* treatment is, to encourage, or excite, the process of ossification in the cartilaginous callus, so as to complete the reparation. The fulfilment of this indication consists in the continued treatment of the case as one of fracture; namely, by the reapplication of appropriate retentive apparatus, observing to correct any error in its construction or adjustment, which allowed of undue mobility, obstructed the circulation of blood, or the supply of nervous influence. By thus ensuring rest to the part, and the other local conditions that are essential for reparative nutrition, ossification may ensue. Hence, also, any topical application, previously in use, which may have reduced the nutritive vitality of the part, must be discontinued. Inflammation, and its consequences, suggest indications of local treatment. Another general indication is; to supply, if possible, any defective quality of blood referable to any of the *Blood-diseases*, which are severally known to exercise some degree of prejudicial influence on the ossification of callus. Their pathology and treatment are considered in previous Chapters. Medicinal treatment should be supplemented by hygienic measures. The physiological relation of diet to the process of fracture-union, is not more exactly understood than its relations to other processes of reparative nutrition,—an important subject demanding much further investigation; therefore, with regard to Fracture, it can, at present only be viewed empirically. Experience shows, that a liberal proportion of animal food, with wine, beer, or spirits, according to the patient's previous habits and present condition; constitute an efficacious diet; and that exercise daily in the open air, proves specially beneficial. If the limb be encased in a starched bandage, and slung from the shoulder, the patient will be enabled to move about without interrupting the consolidation of the callus.

These precautionary and soliciting measures having failed; there is no alternative but to have recourse to some operative procedure. Various other manipulative proceedings have been proposed—*e.g.* friction, or with stimulating embrocations, and the application of galvanism; but no such measure has any known direct relation to the process of ossification; nor are their results sufficiently successful to justify the further postponement of operation.

The only question, therefore, is, the *kind* of operation, which may now be requisite. It should be remembered that a *callus* already exists, only in an unossified state. It would be unsurgical to undo what Nature



has already so far accomplished, by any procedure of a destructive character.

*Acupuncture, or subcutaneous incision*, of the cartilaginous callus, has often had the desired effect of inducing ossification. Either operation is easily performed. The one by puncturing the callus in two or three places, with the view of starting as many centres of ossification; for which purpose, Brainard's perforator,\* or the Archimedean drill, being more handy, may be used. The instrument is introduced through the skin and subjacent integuments, and, having pierced the callus at one point, is reapplied at another point, and so on, without withdrawing it from the skin. The other operation is accomplished by dividing, or at least incising, the callus, subcutaneously, with a tenotomy bistoury, or a long narrow-bladed knife. In either proceeding, care must be taken, if possible, to avoid wounding any nerve or vessel of magnitude, adjacent to the callus, and to which it may be attached; and to at once close up the puncture, or the aperture, lest the fracture become permanently compound. Obviously, however, in proportion as either operation may have *this* tendency, or *that* liability, its propriety will be questionable.

In the remarkable case of ununited fracture of the femur, already alluded to, as having occurred at University College Hospital; subcutaneous section was partly successful. In May of the following year, 1848, the late Professor Miller† reported five cases of ununited fracture thus treated successfully. The operation appears to have been a compromise between division and puncture; the callus having been freely *irritated* at several points with a small tenotomy bistoury. This practice was successfully imitated by Mr. G. F. Sandford, of Davenport, Iowa, in two cases;‡ and others might be cited.

(b) *Complete non-union* suggests the same treatment—local and general; and also the removal of any other local cause which may be open to detection and surgically accessible. Thus, an intervening piece of dead bone, or other mechanical impediment to union, may be removed. These remedial measures not succeeding; then and then only is further operative assistance indicated. And what operation? There is no connecting medium whatever, and the ends of bone have already undergone partial absorption. Consequently, the indication is, to remove the comparatively lifeless and altogether ununited ends of bone. *Excision* is preferable to *scraping* or *rasping*, which, leaving the ends in a somewhat contused state, is less favourable to healing. Both modes of operation convert the fracture into compound. Excision was first practised by White,§ of Manchester, in 1760, and it has since been attended with variable success in the hands of different Surgeons. Of 39 cases, collected by Norris, in which the ends of bone were excised or rasped; 24 were successful, 7 remained ununited, and 6 were fatal. But the unsuccessful results of this, as of other operations, may perhaps be explained, by analyzing the *cases* in which the operation is practised, and the mode of its performance.

Excision for completely ununited fracture is, in my opinion, peculiarly appropriate where the ends of bone cannot be retained in apposition; owing to an *oblique* direction of the fracture, a comparatively rare case;

\* Trans. Amer. Med. Assoc., 1854, vol. vii.

† New York Journ. Med., July, 1848, p. 134.

‡ Trans. Amer. Med. Assoc., 1850, vol. iii. p. 355.

§ Dict. de Méd. vol. xiii. p. 503.

or to *deformity* of the bone, as from rickets. A successful case of this kind, in which I excised an inch of either end of bone, has already been referred to. In fracture, from, or with, *locally diseased* bone; in compound fracture, with protrusion and *contusion* of the fragments; and in all cases of fracture *completely* and *persistently* ununited; excision is specially indicated, and may be practised successfully. *Subcutaneous* or superficial bones are peculiarly eligible for the operation. Its performance should be guided by two most important rules; the one negative—not to disturb the ends of bone from their bed, more than is necessary for excision; the other—a positive injunction—to remove as much bone as may be requisite, thin slice after thin slice, if necessary, to expose a healthy surface of bone at either end. Their apposition, or at the most, easy contact, is then the only local condition essential to union. Primary union should be solicited by closing the aperture, thus endeavouring to reduce the fracture to the simple condition.

Other operations have been proposed and practised, to excite repair. The passing a *seton* between the ends, as was first successfully applied by Dr. Physick, of Philadelphia, in 1802;\* or, when this proceeding is impracticable, passing a seton *around* each end, as was suggested by Oppenheim. But, either way, this operation does not remove the inert ends of bone, nor can the fracture possibly be reduced to a simple condition. The seton should not be allowed to remain longer than to induce inflammation, without much suppuration. This may take place in a week or ten days; or by that time, the ends of bone may be in a well of pus. Success has followed this operation, in fracture of the lower jaw, the clavicle, bones of the forearm, and the humerus; while, in the other chosen seat of ununited fracture, the femur, it has been nearly a total failure. A loop of silver wire around either fragment, has been substituted for the seton; whereby also the ends have been tied together, or the wire has been tightened from time to time, until it has cut its way out. Both these modifications of the *metallic ligature* are equally objectionable, essentially, although not equally, provocative of profuse suppuration. Metallic ligatures have proved successful in the hands of Horeau; J. K. Rodgers, Mott, and Cheeseman, of New York; N. R. Smith,† and Flaubert.‡ But, Norris saw an instance of ununited fractured patella, in which this treatment was fatal on the fourth day.

(c) *False joint—incomplete*—presents a different structural condition, yet a further consequence of ununited fracture. Any operation of a destructive character, as by the removal of the ends of bone—although partially absorbed and indisposed, therefore, to unite—is overruled by the fact, that a connecting medium, in the shape of a band or bands of *ligamentous tissue*, already exists, which may be induced to become the *matrix* of ossification. Hence, in this case, the *introduction* of a *foreign body* here and there, around the false-joint, may have this result. The operation, originally proposed by Dieffenbach, can be readily accomplished; by cutting carefully down to the seat of fracture, drilling holes in the fragments, with Brainard's perforator or the Archimedean drill, taking care that the point does not slip to either side of the bone, into perhaps a large artery or nerve; then introducing ivory pegs, four, five, six, or more, and driving them home with a mallet. The fracture, thus

\* Med. Repository of New York, 1804, vol. i.

† Malgaigne's Work, trans. by Packard, p. 255.

‡ New York Journ. Med., 1839, vol. i. p. 343.

made compound, is reconverted into simple, by at once closing the incision with sutures, and lint-dressing. It may remain simple, but generally the wound reopens, with immense swelling around the part and profuse suppuration. Thence the peril, to limb and life, of this operation. The pegs must be forthwith extracted, leaving the fracture in a worse state than before; thus rendering amputation perhaps unavoidable, and even sacrificing the life by the severe constitutional disturbance. If the wound remains tolerably quiescent, and consolidation of the fracture is found to have taken place after the lapse of a month or six weeks, the line of incision must be reopened by an incision and the pegs withdrawn, their extraction being very easily accomplished owing to partial absorption or disintegration of the portions impacted in the bone. The wound may possibly again heal by primary union; or now run the course of granulation and free suppuration tediously to recovery, and with considerable impairment of the general health, consequent on the double operation and protracted process from first to last.

Various authors bear testimony to "several" and "numerous" instances of perfectly successful results, in their practice; but I am unable to find the particulars of such cases. For my own part, I have not hitherto experienced, nor witnessed, much of a satisfactory character in the results of this operation. But my experience has been limited. In one case of false-joint of the humerus, at about the insertion of the deltoid muscle, I introduced four ivory pegs. That operation failed. I repeated it, and it caused such swelling and tension of the arm as to compel me to withdraw the pegs; but the false-joint remained nearly as moveable as before this twice-performed operation. In another case, a false joint of the femur, about the junction of the lower and middle thirds; I saw the same operation performed, but it was not repeated, and the result was not more effectual.

(d) *Complete false-joint*—the most irrecoverable structural condition—suggests the same operation as for the incomplete condition; the introduction of ivory pegs, as foreign bodies, to induce ossification in the capsular ligament already existing as a matrix. But it should be thoroughly considered, whether the uncertainty of such reparation taking place, and the peril of the operation, are not advantageously counterbalanced by a condition of structure, which although not that of united fracture, is yet a firm connexion, and with which the limb is proportionately useful. Under these circumstances, it may be *better* "to let well alone."

DISUNITED FRACTURE is a parallel condition to Ununited Fracture. Union having taken place, and with firm osseous consolidation; a Fracture may again become disunited, loose and moveable. The *causes* of disruption may be local; as mechanical violence, occasioning immediate destruction of the callus, or inflammation affecting it, and operating more slowly; or possibly some constitutional causative condition, as scurvy. The *treatment* accordingly must have reference to the nature of such causes.

---



## CHAPTER XXX.

## SPECIAL FRACTURES.

FRACTURES OF THE CRANIUM.—These Fractures are so intimately related to Injuries of the Brain, that they are more conveniently considered with those lesions—see HEAD-INJURIES.

FRACTURES OF THE SPINE—see SPINE.

## FRACTURES OF THE FACIAL BONES.

1. FRACTURE OF THE NASAL BONES.—*Structural Condition.*—Displacement of the bones may be slight; or the bridge of the nose, flattened or sunk; with more or less contusion of the integuments, extending even to the cheeks. The lachrymal bone, occasionally, participates in the injury, with rupture of the lachrymal sac, or of the nasal duct. The cribriform plate of the ethmoid bone has, it is said, been found driven up into the brain, thus occasioning serious or fatal injury to that organ.

*Signs.*—Hæmorrhage from the nose is sometimes profuse and persistent. In one case, in the Hospital, a policeman—whose nose had been broken on several occasions of conflict with ruffians—nearly bled to death. The *appearance* of the nose before the supervention of swelling, is characteristic, if there be much displacement; and then, the loose mobility of the fragments, and their crepitation in the spongy swelling, when lightly handled with the fingers—feeling sometimes like a bag of fragments—will, at once, suffice to detect the nature of the injury. Discharge of tears over the face, with emphysema of the eyelids and forehead; denote an extension of the fracture laterally to the lachrymal bone. Some symptoms of concussion of the brain may accompany the fracture; or those of compression, owing, probably to an extension of the fracture to the ethmoid plate.

*Causes.*—*Direct* violence is the only mode of fracture of the nasal bones. And such force must, usually, be considerable, to break down the articulations of these bones with the frontal and superior maxillary bones. A severe blow or fall, are the ordinary causes of this injury.

*Course and Terminations.*—Union takes place, and with tolerable readiness, in most cases. But exfoliation of portions of the bones, with a fætid discharge, may prolong the recovery for some time. In one such case, under my care, the patient having broken his nose by a fall, he subsequently received some further damage from the brim of his hat being accidentally thrust over his brow in getting out of an omnibus. The angular depression, where the formerly prominent bridge of his nose had been, and the upturned or snubbed extremity of the nose, gave him an unhappily conspicuous appearance. Shortly, a fætid discharge commenced, and continued so profusely, as to run downwards into his throat when he lay down, or from the nostrils when he sat up. This offensive condition, with a claspings, bewildering pain across the forehead, and constant sleeplessness or horrid dreams, made his life miserable. Exfoliation of portions of bone, from time to time, gave him occasional relief.

*Treatment.*—Without displacement of the bones; cold lotions, or other

applications, to subdue the inflammatory swelling, will be the only interference requisite. With displacement, the bones must be adjusted by a little manipulation externally, and within the nostrils by means of a director or other such instrument. Compresses should then be applied to retain the bones in position. *Persistent hæmorrhage* can be arrested only by plugging the nares, posteriorly and anteriorly, irrespective of any immediate consideration for the fracture. This proved effectual in the severe case of the policeman. The fracture may be adjusted in the course of a few days. *Exfoliation* of the bones and discharge, must be treated according to circumstances. Alum injections, and the administration of iodide of potassium, proved signally beneficial in the case above referred to; although the history of the gentleman—a married man, and beyond middle life—gave no evidence of any syphilitic antecedents.

2. FRACTURE OF THE MALAR BONE.—Comminuted, in most cases; displacement of the fragments is inconsiderable, although spiculæ may be driven into the temporal muscle. The mobility and crepitation of the broken portions, are scarcely rendered imperceptible by the swelling, which however is often most conspicuous.

*Direct* violence is the only cause, and the violence must be very great, as the bone, thick and solid, and supported by its surrounding articulations, offers great resistance. Hence, fracture rarely occurs, compared with that of the nasal bones, although the malar is equally exposed. A heavy blow, however, on the malar bone, produces a starred and radiated fracture, just as a thick plate of glass, in a frame, is broken by a stone.

*Treatment.*—Cold lotions may be applied in the first instance. Adjustment of the fragments will hardly be necessary, but they may be retained in position by compresses suitably placed. The pain ensures rest, any attempt to masticate or speak being intolerable. Fragments driven into the temporal muscle should be removed.

3. FRACTURE OF THE ZYGOMA may occur with, or without, fracture of the malar bone. In one case, I found the *articulation* of the zygomatic process of the temporal bone with the malar, severed, unaccompanied by any fracture.

The broken or disarticulated ends of bone must be kept in apposition *secundum artem*.

4. FRACTURE OF THE UPPER JAW.—The *nasal process* of the superior maxilla is liable to fracture with the nasal bones; and this must, perhaps, occur if the fracture extends outwards to the lachrymal bone, across the nasal process of the superior maxillary bone. The *alveolar process* also, a much thicker portion of this bone, is sometimes broken. The *malar eminence*, externally, may participate in fracture of the malar bone with which it articulates; and the *Antrum* of Highmore is, sometimes, crushed.

*Direct* violence only can occasion these severe injuries. Gunshot wound, or the handle of a crane revolving and striking the face, thus produces fracture; involving, possibly, all the bones of the face in one common smash, or disjunction, with pulpification of the integuments. The face “feels like beans in a bag.” I have seen two such facial bags; the one resulting from machinery, the other from the compression of a cart wheel passing over the face.

*Treatment.*—The contusion, which accompanies fracture of any portion of the upper jaw, always requires the application of cold lotions or

the usual means to subdue inflammatory swelling. Adjustment of the fragments must be accomplished by proper manipulation, and retained by any suitable contrivance.

5. FRACTURE OF THE LOWER JAW.—*Structural Conditions*.—This bone may be broken in any part; the *body*, and particularly *between* the symphysis and insertion of the masseter muscle, rarely at the *symphysis*, in the *rami*, or the *processes*. Commonly, fracture is limited to one side of the bone. Its direction may be transverse, or oblique; and in the latter form of fracture, the pointed end of the anterior portion is apt to pierce the mucous membrane of the mouth, or to be tilted upwards by the depressing action of the genio-hyoid muscles; thus, in either way, rendering the fracture *compound*. This condition of fracture in the lower jaw, has, I believe, been questioned; but I distinctly found it in one instance of fracture of the body on the left side, which had become compound, in the course of a few days, by the tilting effect of the depressor muscles; the nature of the injury having been overlooked and no retentive apparatus applied.

The *Signs* are; some unevenness along the base of the jaw, and irregularity of the teeth, with mobility and crepitus when the parts are handled. The patient even experiences a harsh grating sound, conveyed through the temporal bone, as well as pain, on moving the jaw. The anterior portion is drawn downwards by the genio-hyoid muscles, and particularly if the fracture be in front of, and therefore unresisted by, the masseter muscle. Fracture on either side of the symphysis allows the middle, intervening, portion of bone to be drawn more downwards. In any case there is also dribbling of the saliva; which, at first, has a bloody tinge, from laceration of the gums, especially if the fracture be compound. Fracture of the *processes* is less easily recognised. The condyloid process, when detached, will be drawn forwards by the external pterygoid muscle.

*Direct* violence is always the cause of fracture in the lower, as well as in the upper jaw; and such force must be considerable, as the bone is very thick, and readily moves from side to side.

*Treatment*.—Adjustment of the fragments can be easily accomplished, but less easily retained. A pasteboard or gutta-percha splint may be moulded to the base of the jaw; the upper jaw being used as a splint above. A four-tailed bandage, with a hole in the centre to receive the chin, is then applied; two ends tied over the top of the head, and two behind the neck, thereby fastening the jaw, both ways, in position. Fluid nourishment only is allowed, which can be sucked in between the teeth. Double fracture, and near the symphysis, with greater depression of the fragment, requires the more steady and firm support of the clamp apparatus, contrived by Lonsdale. Loose teeth may, possibly, be preserved by fastening them to the sound teeth with fine gold or silver wire. But any tooth which would prevent even apposition of the fragments, should be removed. Advantage may perhaps be taken of the opening thus made, to feed the patient through a suction-tube, during the process of reparation. Union takes place usually, in a month or five weeks.

FRACTURE OF THE HYOID BONE.—This injury occurs very rarely. In one instance I have seen a fracture at the junction of the great cornu with the body of the bone, on the left side.

The mobility, and some displacement of the fragments are sufficiently characteristic.



*Direct violence* would seem to be the only occasion of hyoid-fracture, as by the grip of an assassin; but it is said to have been produced also by muscular action. Hanging, another instance of force compressing the hyoid bone, does not, I believe, produce fracture of the hyoid bone. At least in one case, having, by permission of the Sheriffs, examined the throat of a man after execution at the Old Bailey; I found no fracture of this bone, although the rope, producing a deep, purple indentation, had passed directly over the bone.

*Treatment.*—Adjustment of the fragment is easily accomplished. Its retention in position is far more difficult, owing to the mobility of the part, and the recurrence of deglutition. It has been proposed to embrace the neck in a firm pasteboard collar, as a splint; and thus fix the bone externally. The liability of displacement in other directions, by muscular action, still remains a difficulty to be overcome.

**FRACTURE OF THE RIBS, AND COSTAL CARTILAGES.**—*Structural Conditions.*—One or more ribs, even several, may be fractured. Seven and eight ribs I have seen broken, counting from the second downwards. The first, and perhaps the second rib, are seldom fractured, they being protected by the clavicle; and the last two false ribs also escape, as being floating, or freely moveable. The mid-ribs, most exposed and fixed, are, usually, the seat of fracture. Any part of a rib is liable to be broken, by direct violence; but the convexity, or near the angle, yields mostly under the force of compression. Thus the mid-ribs, somewhere in a line from the axilla downward, present the fracture commonly met with. Displacement may be outwards, or inwards; rarely upwards or downwards, the intercostal muscles apparently restraining the broken ends in either of these directions. The pleura and lung are specially liable to injury simultaneously; rarely, the pericardium, or heart, the diaphragm, and liver.

*Compound fracture* occurs sometimes, as by gunshot wound.

The *Signs* of fracture are; crepitus, and some mobility, felt on placing the hand over the seat of injury, while the patient coughs or breathes hurriedly; and some irregularity or flattening in the course of the ribs can usually be detected, at least during such respiratory action. A catching pain occasionally disturbing the respiration, elicits these signs more palpably. Hence the breathing is soon restrained, and becomes more abdominal. Hæmoptysis, or a spitting of blood, pneumothorax, or a tympanitic accumulation of air in the pleura, and general emphysema of the subcutaneous cellular texture, may be further signs of fracture; indicating that the injury implicates the pleura and lung, that both are penetrated by the fractured end, or ends, of bone. These additional *thoracic* symptoms are all-important, as the respiration will then be yet more embarrassed. But great oppression may also arise from compression of the chest by the act of fracture, without any penetration of the pleura and lung.

*Causes.*—*Direct violence* as the cause of fracture, produces displacement inwards, with, probably, some wound of the pulmonary organs, or other viscera occasionally. *Indirect violence*, as compression of the chest by a wheel passing over it, produces displacement of the fractured ends, outwards, and confusion of the viscera. The former condition of injury will, probably, be limited; the latter more extensive; the one also may be fracture of any rib, at any part of its extent; the other is generally that of the mid-ribs, at their convexity. Loss of elasticity in the ribs would seem to render persons of advanced years, more liable to fracture occurring from any

compressing force. *Muscular action* has been known to cause fracture of the ribs; as by contraction of the abdominal muscles during parturition.

*Course and Terminations.*—Fracture unattended with any damage to the thoracic organs, proceeds favourably; union of the ribs taking place, with facility, in four or five weeks. Penetration of the pleura and lung may be followed by some inflammation of either, by pleurisy or pneumonia. Usually, however, any hæmoptysis, pneumothorax, or general emphysema, ceases after a time; and any inflammatory action supervening, has not a fatal issue. Contusion of the viscera by compression may soon prove fatal; but the almost momentary subjection of the chest to such force, is sometimes followed by no unfavourable consequences, although there be extensive fracture of the ribs.

*Treatment.*—Fracture, by itself, requires only the application of a broad rib-bandage round the chest, in order to arrest thoracic respiration; thus securing the ends of bone in apposition, and at rest as much as possible. Any displacement may be overcome by compresses suitably applied; as over the sternum, to increase the convexity of the ribs, in the case of displacement inwards; or two compresses, one on either fractured end, in the case of projection outwards. The rib-bandage is itself secured in position, if necessary, by a vertical bandage over the shoulders, and abdominal strips passing round the buttocks below. These accessory restraints are useful in fat persons. A broad roll of adhesive plaster may be drawn once or twice round the chest, instead of a rib-bandage. It answers better, probably, mechanically, and is not likely to shift its position; but it is a dirty, irritating thing, and as such I rarely use plaster, unless several ribs are broken. Medicinally, an anodyne cough mixture may be of service, to allay the pain, and cough of irritation, consequent on the respiratory movements; but if the chest be well fixed, the ease experienced will be considerable.

*Penetration of the pleura and lung* is more important than the fracture. Hæmoptysis, pneumothorax, and emphysema, alike require moderate depletory measures; thus to reduce the general circulation, and to relieve the embarrassment of the respiration occasioned by compression of the lung, in pneumothorax, or of the chest, in emphysema. Venesection, therefore, sometimes proves singularly beneficial, affording instant relief. In a case under my care in the Hospital, emphysema extended from the chest downwards to the iliac fossa, on the left side; attended with the usual crepitation, stuffed appearance, and great oppression of the respiration. Mr. Jeaffreson, the House Surgeon, seeing the urgency in this case, at once bled the patient, taking away more than a pint of blood. The effect was marked, and almost magical. Panting and prostrate as the man lay, before losing blood; he soon sat up and breathed freely; recovering without any further unfavourable symptoms. Scarification of the emphysematous cellular texture may sometimes be resorted to, alone, or with venesection. But the air gradually disappears, spontaneously in most cases. *Paracentesis*, or tapping the chest, has been performed for the relief of severe pneumothorax.

*Inflammation of the pleura or lung, supervening*, must be met by the treatment appropriate for pleurisy and pneumonia.

*Compound fracture of the ribs, resulting from gunshot wound*, is similar in all respects; otherwise than relates to the treatment of GUNSHOT WOUNDS.

FRACTURE OF THE COSTAL CARTILAGES may occur in any part of

their extent from the ribs to the sternum, or at their articulations with either of these bones—a dislocation, more strictly speaking. The pathology being analogous to that of fractured ribs, the treatment requires no special notice.

**FRACTURE OF THE STERNUM.**—*Structural Conditions.*—Analogous to fracture of the ribs, in most particulars; fracture of the sternum is transverse, and usually single; but this bone may be broken into three or more pieces. Displacement seldom occurs, and then the lower portion overrides the upper. Extravasation of blood into the anterior mediastinum, injury of the pericardium and heart, or of the pleura and lung; may severally accompany fracture. Fracture of the sternum is usually accompanied with fracture of the ribs, in their convexity; the same compressing force producing both injuries simultaneously. I have never yet seen the sternum broken alone.

*Compound* fracture occurs sometimes, as by gunshot wound.

The *Signs* of fracture are; crepitus, and some mobility, felt on applying the hand over the sternum during coughing or the hurried respiratory movements; and some inequality of the bone, with any displacement, will be perceptible. The respiration is principally abdominal. Hæmoptysis and emphysema, or severe palpitation, are present, when the injury involves the lung or heart. Or these organs may evince symptoms of having suffered compression, without penetration.

The *Causes* are; *direct* violence, as the wheel of a carriage passing over the chest, or gunshot wound; but the elastic and yielding nature of the ribs and their cartilages, and the spongy texture of the sternum, resist fracture of this bone. Hence although much exposed, it is rarely fractured. *Muscular action* also is said to have caused fracture; as violent contraction of the abdominal muscles during parturition, efforts at lifting heavy weights, or a fall on the back across a beam.

*Treatment.*—Position is of some importance, to relax the abdominal muscles more especially; and thus prevent displacement of the lower portion of bone forwards, which would result in angular deformity. If the patient be recumbent, the pelvis should be slightly raised; or sitting up, the shoulders should incline forwards. A broad bandage encasing, and fixing the chest, is applied, as for fractured ribs.

**FRACTURE OF THE CLAVICLE.**—*Structural Conditions.*—The Clavicle

may be broken in any part of its extent; commonly, in one of its two curves, and particularly, in its outer or scapular concavity. Rarely, fracture occurs external to the coraco-clavicular ligament—in that part of the bone between it and the acromion. This distinction is important with regard to symptoms, causes, and treatment. Hence, fractures of the sternum are divided into those on the *sternal* and those on the *scapular* side of the *coraco-clavicular* ligament, which is attached to the rough oblique line on the under surface of about the outer inch and a half of the bone. On the

FIG. 98.



*sternal* side of this ligament, fracture is usually oblique (Fig. 98); but



it may be comminuted, from direct violence. On the scapular side also, the bone may be similarly fractured. Displacement, in any notable degree, occurs only with fracture on the sternal side of the ligament, in the outer curve where the bone usually yields. The outer or scapular portion is alone displaced; the inner portion being retained in position by the costo-clavicular ligament, and the opposed action of the sternomastoid and great pectoral muscles. The displaced portion is drawn downwards, forwards, and inwards; under, perhaps, the inner portion. This displacement is partly due to the weight of the arm, having lost its support from the sternum; but principally it results from the action of the deltoid and great pectoral muscles, the latter muscle drawing this portion of the bone forwards and inwards. The structures adjacent to the clavicle are rarely injured with, or by, the fracture. The axillary plexus of nerves and the subclavian vein, have, severally, been wounded. Both these additional injuries were present, I believe, in the fatal case of the late Sir Robert Peel, whose left clavicle was fractured, and comminuted, by a fall from his horse. The injured vein led to the formation of a "diffused false venous aneurism," as large as the hand might cover, below the fractured clavicle, and which pulsated to the touch synchronously with the action of the heart, or rather with the contractions of the auricle.

*Compound* fracture has been known to occur, by direct violence, or as the result of a very oblique fracture protruding through the skin.

The *Signs* of fractured clavicle are characteristic. On the *sternal* side of the coraco-clavicular ligament; a depression, corresponding to the displacement, is readily detected on passing the finger along the bone, crepitation also, and mobility of the outer portion, on raising and rotating the shoulder, the elbow being kept to the side. Pain is caused by this manipulation; and the patient is unable to raise his hand to his head, the support of the clavicle, necessary for this semicircular motion of the arm, having given way. The patient, with his other hand, holds the arm up to his chest, to relieve the powerless weight, and inclines his head to the injured side, to relax the muscles passing from the clavicle to the head. This peculiar attitude of the patient is accompanied with a marked falling of the shoulder inwards towards the sternum, approximating the interval between these points, thus declaring the nature of the injury almost at a glance. Examination, as above directed, will be conclusive.

On the *scapular* or outer side of the coraco-clavicular ligament, fracture is less obvious, but still easily discovered. Slight displacement of the fragment downwards and drooping of the shoulder, may be observable; but this irregularity disappears on pressing the arm upwards; and crepitus, with some mobility of the fragment, are felt on raising and depressing the humerus, the hand being placed over the shoulder at the seat of fracture. The motions of the arm are scarcely impaired, as a sufficient support in the larger portion of the clavicle remains.

*Causes.*—*Indirect* violence, the more common cause, produces fracture in the usual situation—the outer curvature, and obliquely across the clavicle. The long and slender form of this bone, and its function, that of supporting the upper extremity from the trunk, render it peculiarly liable to fracture, in receiving every impulse through any of the component bones of this extremity. Thus, falls on the hand, elbow, and shoulder especially, are common causes of fracture in the curve of the

clavicle. *Direct* violence produces fracture in the part struck, and probably of a comminuted character. Thus, any part of the bone, on either the sternal or scapular side of the coraco-clavicular ligament, may be the seat of fracture from direct violence. The subcutaneous and exposed position of the clavicle, renders it liable to fracture in this way. A heavy, crushing blow illustrates the corresponding class of causes.

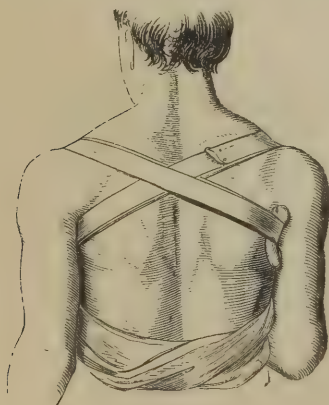
*Treatment.*—On the *sternal* side of the coraco-clavicular ligament; displacement of the outer fragment, inwards, forwards, and downwards, must be overcome by giving the humerus an opposite direction, outwards, backwards, and upwards. The first direction is accomplished by

FIG. 99.



of the neck. Inclining the arm inwards across the chest, until the hand points upwards to the opposite shoulder; a few turns of a roller round the chest enclosing the arm, above the elbow, will secure this position (Fig. 99). The forearm

FIG. 100.



a *pad* in the axilla; and the latter two, by inclining the arm inwards *across* the chest and *raising* the elbow. To secure the pad and arm in this position, many contrivances have been used. Before applying any such retentive bandaging or apparatus, it is well to provide against the supervention of swelling in the arm and hand, by padding the palm with cotton wadding or other soft material, and bandaging from the fingers upwards to near the axilla. Then a good-sized pad, enclosed in a handkerchief, should be placed well up in the axilla, and the arm close to the side, so as to draw outwards the scapular portion of the clavicle to an even apposition with the sternal portion; the pad being secured in its place by tying the handkerchief at the opposite side

should then be slung in another handkerchief, from the hand to the elbow; care being taken that the elbow is well supported, upwards. Any particular shifting or loosening of these simple retentive appliances, subsequently, must be corrected; but the fracture should not be re-adjusted unnecessarily. Union will have taken place, generally, in about three weeks.

Other contrivances may, occasionally, be more suitable; and particularly in fracture of both clavicles.

The shoulder can be *drawn* backwards, and thus kept in posi-

tion, by a *figure-of-8 bandage* across the back and front of the chest, winding under either axilla. (Fig. 100.) The other appliances are the same as those already noticed; an axillary pad, and a sling for the arm. Excoriation of both axillæ is apt to be produced by this form of bandage.

*Brasdor's apparatus* removes this objection to a *figure-of-8 bandage*. Two well-padded straps are used, one under either axilla, which are buckled to a back-piece of stout leather, from which two perpendicular straps pass down to a belt around the waist; thus securing the whole apparatus in position. The back-piece consists of two portions, laced together according to the size of the chest.

Fracture on the *scapular* side of the coraco-clavicular ligament, may be treated in the same way as on the sternal side; the axillary pad, however, being of *smaller* size, the arm bandaged to the *side*, and the forearm supported in a sling, *slightly* raising the elbow.

In *children*, the clavicle may be bent, and this condition mistaken for fracture; the signs of fracture, in childhood, are also less perceptible, and obscured in a few days by soft-union. *Treatment* is often very unmanageable, by bandaging; and the fracture may, perhaps, be best secured by the starched apparatus.

**FRACTURE OF THE SCAPULA.—Structural Conditions.**—Fracture of the Scapula is liable to occur in any part of the bone; but in some parts commonly, in others rarely. This distinction has reference, apparently, to the more or less exposed situation of the bone, in its different parts. Thus, the *inferior angle* is more commonly fractured than the *body*; the *acromion* commonly; the *coracoid process*, and the *neck*, both rarely. The *glenoid cavity* may be starred, but *very* rarely.

(1) The *Inferior Angle* is simply broken off, and displaced forward, being drawn in that direction by the attached portion of the serratus magnus, and by the teres major and latissimus dorsi muscles.

The *Signs*, therefore, are; this displacement, and the mobility of the fragment apart from the body of the bone, or the stationary position of the *angle* when the scapula is moved.

(2) The *Body* may be fractured transversely or longitudinally; in the

FIG. 101.



FIG. 102.



former direction usually, and close below the spine of the scapula. (Fig. 101.) Little displacement can take place, the fragments being embraced



by muscles; but with completely transverse fracture, the lower portion is drawn forward.

The *Signs* are; some displacement, in transverse fracture discovered more readily, as an irregularity of the posterior border of the scapula; perhaps crepitus and mobility of the fragments, on using some degree of pressure to and fro in the direction of fracture.

(3) The *Acromion* may be knocked off at its tip, or nearer its root; (Fig. 102); it is drawn downwards and slightly forwards by the deltoid muscle, and the weight of the arm.

The *Signs* are very conspicuous. Downward displacement of the fragment and dropping of the arm, give a marked flattening to the shoulder; and the inequality of the spine of the scapula can be felt on passing the finger upwards in its course to the depressed fractured portion near the clavicular articulation. Crepitus and mobility of this portion of the bone are also felt on pressing upwards and rotating the arm, the other hand being placed over the shoulder; and the deformity of the shoulder then disappears, but it returns when the arm is again allowed to drop. The patient feels as if the shoulder were dropping off, and experiences a great sense of weight and powerlessness in attempting to raise the arm.

(4) The *Coracoid Process* is sometimes knocked off; it will be drawn downwards by the biceps and coraco-brachialis muscles, and inwards also by the pectoralis minor. (Fig. 103.)

The *Signs* are partly obscure; no particular alteration in the shape of the shoulder, though the apex of the coracoid process can be felt lower

FIG. 103.



FIG. 104.



than on the sound side; but mobility of the fragment, with possibly crepitus, are very perceptible on fixing the scapula and moving the arm backwards and forwards.

(5) The *Neck* of the scapula—beyond the root of the coracoid process—is occasionally broken off (Fig. 104), carrying with it the glenoid cavity, and coracoid process, and, perhaps, the acromion, with adjoining portion of the spine of the scapula (Fig. 105), which together fall downwards and inwards by the weight of the extremity.

The *Signs* are; marked flattening, and dropping, of the shoulder, a

depression under the acromion, and a tumour in the axilla; thus far simulating dislocation downwards into the axilla. But, mobility, and crepitus of this apparent head of the humerus, can be readily discovered by placing the hand on the shoulder with the forefinger resting on the coracoid process, and rotating the arm; the crepitus being transmitted through that process, which still remains uninjured in its connexion with the glenoid cavity. Moreover, the deformity of the shoulder disappears, and returns, as this neck-portion of the scapula is replaced and displaced, by pressing the arm upwards, and then allowing it again to drop.

(6) The *glenoid cavity* may be the seat of a starred or comminuted fracture, of which there is an excellent specimen in the Museum at Netley (Fig. 106). The *diagnostic signs* of such fracture would be obscure.

FIG. 105.



FIG. 106.



*Cause.*—*Direct violence* is the only cause of fracture, in any part of the scapula. The body is especially protected by a cushion of muscle, on the back and front of this portion of the bone; and the coracoid process and neck of the bone, are cushioned by the deltoid muscle. Thus protected, the violence must be very considerable, to produce fracture; not unfrequently, the subjacent ribs are broken simultaneously, and severe contusion or laceration of the soft parts, with such additional injury, give rise to serious consequences.

More than one fracture of the scapula may have occurred; or fracture, concurrently, of the upper end of the humerus.

The occasions of direct violence are various. A heavy fall on the shoulder may fracture the acromion, coracoid process, or neck of the scapula; a severe blow, as by the pole of a carriage, has fractured the coracoid process; and gunshot injury of the back may fracture the body of the scapula.

*Treatment.*—The direction of the *displacement* indicates the proper position of the limb, and the application of retentive bandaging.

Displacement forwards of the *inferior angle*, or a portion of the *body* of the bone, will be corrected by drawing the arm inwards, and thence the scapula forward, in order thus to meet the fractured portion which cannot easily be kept back. The arm must then be secured in that position,

by a few turns of a roller round the chest, and the forearm rested in a sling.

Displacement downwards and forwards, of the *acromion*, or downwards and inwards of the *coracoid process* of the *neck* of the scapula; may be rectified by elevation of the arm with an inclination inwards, in order to replace the fractured portion upwards and backwards, or upwards and outwards. In fracture of either of these portions of the bone, the downward tendency—with flattening and dropping of the shoulder—is more marked than any tendency forward, or inward. Having, therefore, secured the arm slightly in front of the chest, by a few turns of a roller; the forearm must be well supported in a sling, especially at the elbow. In fracture of the neck, an axillary pad will be necessary to guard against the recurrence of displacement. Thus, the treatment of fractures of the scapula, and of the neck in particular, resembles that for fracture of the clavicle.

*Contusion* of the soft parts, often severe, may render it impossible or improper to finally adjust the fracture, until the swelling and pain, thence arising, have partly subsided under the application of cold lotions or other appropriate measures.

**FRACTURES OF THE HUMERUS.**—Fracture of the Humerus is liable to occur in any portion of this bone; in the Upper Articular end, the Shaft, or in the Lower Articular end.

**FRACTURE OF THE UPPER ARTICULAR END** may occur in three situations. (1) *Intracapsular* fracture—within the capsule—or of the *anatomical neck* (Fig. 107) The head remains in the glenoid cavity, while the shaft

Fig. 107.\*



of the bone is drawn upwards and forwards to the front and outer side of the coracoid process. It was formerly a question whether this fracture ever occurred. The possibility has long since been verified by dissection. Such a case is described in Sir A. Cooper's work; and similar individual specimens are re-

corded as having been seen by Bichat, Delpech, Robert Smith, in two cases, Pirrie, and other authors.

**Signs.**—A projection, corresponding in situation to the end of the lower portion—the shaft, can be felt on the outer side of the coracoid process; and some flattening *lower* down, may be perceptible—the deltoid being spread inwards by the shaft. But immediately below the acromion there is no hollow, the head of the bone remaining in the glenoid cavity; and this negative difference in the outline of the shoulder distinguishes fracture of the neck of the humerus from dislocation. Crepitus, and immobility of the head of the bone, may also be felt on extending and rotating the humerus; if the muscular development of the deltoid and the swelling consequent on contusion, do not together form a cushion of such

\* This Fig. shows intracapsular fracture, with dislocation forwards, under the pectoral muscle. (Sir A. Cooper.)



thickness as to obscure these signs. Slight shortening of the arm will be discovered by measuring, as compared with the other arm, the distance between the acromion and olecranon processes. Considerable pain is experienced on moving the arm in examination; and it hangs powerless by the side.

*Impacted fracture* of the anatomical neck, is attended with a notable absence, or less degree, of the ordinary symptoms; the shaft having been driven into the head of the bone. It more resembles dislocation of the shoulder into the axilla.

(2) *Extracapsular fracture*—beyond the capsule—and of the *surgical neck* (Fig. 108), includes the portion of bone below the tuberosities and above the insertions of the three muscles into the bicipital groove, the pectoralis major, latissimus dorsi, and teres major muscles. Fracture in this situation is, sometimes, very oblique. The shaft of the humerus, below the fracture, is drawn inwards and upwards by the action of these three muscles; and the upper fragment outwards, by other three muscles, inserted into the great tuberosity, the supra-spinatus, infra-spinatus, and teres minor, counteracted, however, by the sub-scapularis muscle inserted into the small tuberosity.

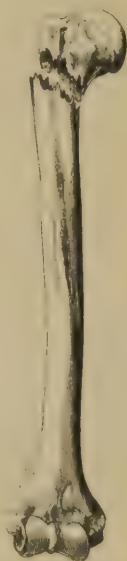
*Signs.*—Deformity of the shoulder is presented—under cover of the deltoid muscle, but *lower* down than in fracture of the anatomical neck. And, the deformity corresponding to the displacement of the two ends of bone, it consists of a *double* projection, inwards of the lower end, and outwards of the upper end. Mobility of the lower end, and crepitus on extension and rotation with some inclination of the humerus inwards, and shortening of the arm, are more perceptible signs. Pain, severe during any manipulative examination, owing to irritation of the axillary plexus by the shaft-fragment, and inability to use the arm; conclude the diagnosis.

*Impacted fracture* of the surgical neck, is chiefly characterized by the absence, or minor degree, of the ordinary symptoms. But the fracture is too low down to be well mistaken for dislocation into the axilla.

(3) *Fracture of the Great Tuberosity*, is an occasional form of fracture of the upper end of the humerus. A double displacement here, also, is produced. The tuberosity is drawn outwards and upwards by the action of the three attached rotator muscles—supra-spinatus, infra-spinatus, and teres minor—this portion of the bone being under and outside the acromion. The head of the humerus is rotated inwards by the sub-scapularis muscle acting on the small tuberosity; it lies on the inner edge of the glenoid cavity, and under the coracoid process.

*Signs.*—Deformity of the shoulder, corresponding to these displacements, is always conspicuous. Marked flattening and great breadth of the shoulder even to double its natural breadth, catch the eye at once. A double projection may be felt; an outer, the tuberosity, an inner, the head of the bone; both, however, lying nearly on the same plane *horizontally*, and with an intervening sulcus or hollow below the acromion. Thus distinguished from fracture of the surgical neck, by the position

FIG. 108.



of the fragments; fracture of the great tuberosity somewhat resembles dislocation of the shoulder, by its sub-acromial depression; and, indeed, partial dislocation *forwards* might be said to have taken place. But the presence of *two* osseous projections is distinctive as to the nature of the injury. Crepitus on approximating the two portions of bone, and mobility, complete the diagnosis.

*Causes.*—*Direct* violence is, mostly, the cause of fracture of the upper end of the humerus. Thus a heavy fall on the shoulder may occasion fracture of the anatomical, or surgical neck, or of the great tuberosity. Protected, however, by the cushion of the deltoid muscle; these fractures are not common, and the first and last are rare. Age seems to favour the occurrence of fracture in the two first named parts; the anatomical neck being broken more frequently in youth, or the surgical neck giving way at the epiphysis. Union may not take place in the former situation, or ligamentous only, if the anatomical neck be completely detached within the capsule.

FIG. 109.



*Treatment.*—These three forms of fracture of the upper end of the humerus, may be treated alike, and with successful results. The fragments having been adjusted by extension of the arm; a pad should be placed in the axilla so as to prevent any re-displacement inwards; a shoulder splint of gutta-percha or paste-board is moulded to the shoulder and arm, both of which are then secured to the chest by a bandage; and the forearm rested in a sling, without raising the elbow, its weight tending favourably to prevent the recurrence of displacement upward (Fig. 109).

*Compound Fracture of the Upper End of the Humerus.*—Often comminuted, and with great contusion of the soft parts; this condition of injury occurs only from gun-shot wound of the shoulder, involving probably the adjoining glenoid cavity, or the processes of the scapula, or the axillary vessels and plexus of nerves.

*Treatment.*—Excision may be performed; when the injury is restricted to the head of the humerus, with, perhaps, splintering of the glenoid cavity or scapular processes. And the best results have followed this operation in such cases. Amputation must be resorted to in any additional injuries to the vessels and nerves.

**FRACTURE OF THE SHAFT OF THE HUMERUS.**—(1) *Below the insertion of the three muscles into the bicipital groove, and above the insertion of the Deltoid.*—Fracture in this portion of the shaft differs only from that of the surgical neck, in the relative displacement of the two portions of bone. (See Fig. 89.) The *upper* portion is drawn inwards, by the three muscles inserted into the bicipital groove; the *lower* portion, outwards and upwards by the deltoid muscle, and in the latter direction especially if the fracture be oblique.

The *Signs* also, thence arising, differ accordingly. Thus, deformity of the arm, corresponding to these displacements, is presented, and consisting

of two projections—an upper and a lower—but the upper will be felt on the *inner* side, the lower, on the *outer* side, of the arm. Mobility of the fragments is very perceptible, giving a hinge-like motion to the arm on the gentlest handling, and crepitus can be readily elicited by extension and rotation; inclination of the humerus *outwards*, with some shortening, of the arm, are equally conspicuous; and although the pain of manipulation may be less, the powerlessness is not less complete, than in fracture of the surgical neck. In a case, recently under my care, of fracture of the shaft just above the deltoid; all these signs and symptoms were well pronounced.

(2) *Below the insertion of the Deltoid.*—Fracture in this portion of the shaft differs only from that above the deltoid, in the relative displacement of the two portions of bone, which are here reversed. The *lower* portion is drawn inwards and upwards, by the flexor muscles; and the more so in proportion to the obliquity of the fracture from above diagonally across the bone. The *upper* fragment may be slightly everted. A projection, corresponding to the lower end, is most perceptible on the inner aspect of the arm; with an inward inclination of the humerus. The other signs and symptoms, mobility, crepitus, shortening, pain, and powerlessness, are similar to those of fracture above the insertion of the deltoid.

*Causes.*—Violence, directly or indirectly applied, is, generally the cause of fracture in both these portions of the shaft. Powerful muscular action has, however, been known to occasion fracture.

*Treatment.*—The ends of bone having been adjusted by gentle extension; three or four splints should be applied, so as to nearly surround the arm, and then be secured in position by a bandage. Bandaging the hand and forearm, will, as usual, be a proper precaution against œdema; and a sling is used to suspend the forearm, not to elevate the elbow, which, hanging down, tends to prevent the recurrence of displacement.

FRACTURE OF THE LOWER ARTICULAR END OF THE HUMERUS.—(1) *Transverse Fracture of the Lower End.*—In this fracture, considerable displacement of the lower or articular fragment backwards, carrying with it the forearm, is produced by the action of the triceps muscle; and a corresponding displacement forwards of the lower end of the shaft of the humerus. (Fig. 110.)

FIG. 110.



The deformity, therefore, consists of a projection posteriorly and anteriorly, which resembles dislocation of both bones of the forearm backwards; but the mobility and crepitus, on extending the forearm, and return of the displacement on relaxation, distinguish these two forms of injury; *fracture* of the humerus transversely, near the elbow-joint, and *dislocation* of both bones of the forearm backwards. Their diagnosis is obviously most important.



Fracture in this situation happens more frequently in adults, though still only occasionally.

(2) *Separation of the Lower Epiphysis.*—The same displacement

FIG. 111.



occurs, and attended with the same signs; the diagnosis from that of dislocation of the forearm backwards, is also similar.

This injury happens only in children, and not uncommonly.

(3) *Fracture of either Condyle.*—

The external or the internal condyle of the humerus may be fractured obliquely outwards, or inwards, and extending into the elbow-joint, thus completely separating the condyle. (Figs. 111 and 112.) Or again; a vertical fracture may extend from the joint upwards, bounded by a transverse fracture through the bone, thus separating *both* condyles.

With *single* fracture, there is not much displacement; but on taking hold of the process between the thumb and finger, it can be moved backwards and forwards, with crepitation; the forearm is flexed and, perhaps, supine.

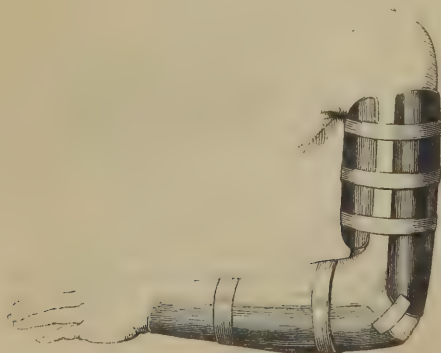
With *double* fracture, there is more displacement, and especially

when the condyles are separated by pressure in the longitudinal fracture; the condyles are freely moveable, with distinct crepitation; the forearm is flexed, and, generally, in a state of pronation.

Contusion, with considerable pain and swelling, usually accompanies these fractures in the vicinity of the elbow; and particularly fracture of either, or both, condyles.

*Causes.*—*Direct* violence, as by a heavy blow or fall on the elbow,

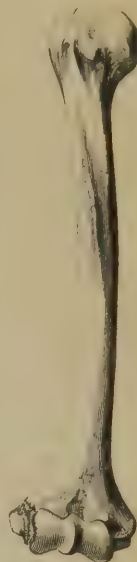
FIG. 113.



is usually, the occasion of fracture, and of the condyles in particular.

*Treatment.*—The swelling which speedily ensues in these fractures, must be subdued, by placing the arm at rest on a pillow, and applying cold lotions, or irrigation. A bottle containing ice-cold water or lotion, with a skein of cotton in the fluid, and hanging out of the neck, forms a simple and effective contrivance. Sus-

FIG. 112.

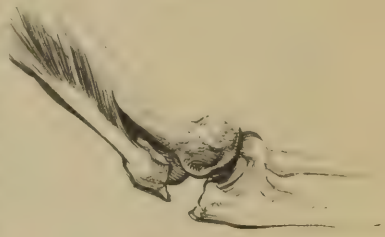


pended over the elbow, a constant dropping irrigation can thus be maintained.

Any displacement having been corrected, the bones are best kept in position by angular splints, which well support the lower end of the humerus, and the upper part of the fore-arm, itself supported in a sling; and thus the patient is allowed to move about. (Fig. 113.) At the end of a month or so, passive motion of the elbow-joint, may be advisable, as a precaution against any tendency to ankylosis.

FRACTURES OF THE FOREARM.—1. FRACTURES OF THE ULNA.—(1) *The Olecranon*.—Transverse fracture not unfrequently occurs, with displacement upwards by the action of the triceps muscle, and which varies in extent according to the complete or partial rupture of the tendinous expansion of this muscle. (Fig. 114.) An interval between the fragments is thus presented; and the forearm being partly flexed by the unopposed action of the flexor muscles, that interval is increased. Mobility of the olecranon, and some crepitation, easily produced when the arm is extended, will confirm the diagnosis. Considerable fluid swelling over the seat of injury, may, however, soon render these signs somewhat obscure.

FIG. 114.



*Causes*.—*Direct violence*, as a smart blow with a stick, or a fall on the

FIG. 115.



FIG. 116.



elbow, is the usual occasion of this fracture; and of the contusion which then accompanies it. Powerful muscular action of the triceps will, sometimes, snap off the olecranon.

Union by ligament occurs in most cases; the length of this band varying from a line to an inch or more. (Fig. 115.) Bony union may take place when the olecranon is in perfect apposition; but not invariably, even in such cases.

*Treatment*.—Reduction of the displacement is effected by a completely extended position of the forearm; and maintained

by means of a splint applied in front of the elbow-joint, passing some distance along the arm and forearm. (Fig. 116.) This position of complete extension has been employed by a large majority of English and American Surgeons, ever since Sir Astley Cooper urged its almost obvious advantages. A slightly flexed position was advocated by Boyer and Desault, and is still preferred by most French Surgeons; chiefly on the ground that this attitude of the arm will be most convenient in the event of ankylosis. But, the rarity of permanent ankylosis after simple fracture, properly treated, whether by the flexed or straight position, overrules this consideration; and the loss of power almost inevitably consequent on the length of ligamentous union in flexure of the joint, is a result of more serious consideration.

Fig. 117.



(2) *Fracture of the Coronoid Process.*—Only 9 cases are on record—according to Hamilton—in which the symptoms were, apparently, referable to fracture of the coronoid process of the ulna; and not one of these cases was established by dissection, actually demonstrating the existence of fracture, opportunity not having permitted of this conclusive evidence. Only 4 specimens—according to the same authority—are known, illustrative, apparently, of this injury; and these are of doubtful character. The line of fracture is represented in the annexed figure. (Fig. 117.) Fracture of the coronoid process, has, generally, been supposed to occur, and co-exist, with dislocation of the ulna, or of both bones of the forearm, backwards; yet there is only *one* example, in which it is probable that this fracture occurred in connexion with such dislocation of the ulna and radius.

*Signs.*—The signs of an injury, the pathology of which is thus obscure, must necessarily be little known with certainty. As associated with dislocation, the signs of that form of injury will be present; and, probably, more prominently than those of fracture. Re-dislocation is apt to take place, when extension of the forearm is discontinued; and this sign has been regarded as diagnostic. It may be so, perhaps, in fracture of the coronoid process with dislocation of the ulna *alone*. Pertaining to fracture—there will be some displacement of the coronoid process upwards by the action of the brachialis anticus—if the fracture be situated at the *base* of the process, or beyond the insertion of this muscle. Fracture of the tip of the process, would not be attended with displacement. Mobility of the process, and crepitation, in the bend of the elbow; will confirm the diagnosis. But—observes Hamilton—“Notwithstanding the confidence with which writers have spoken of the signs of this accident, we are here very much in doubt; nor do we see how these doubts can be removed until we have in detail the symptoms of at least one example, the indubitable existence of which has been subsequently verified by dissection.”

*Causes.*—*External violence* is probably the only cause of this fracture. Direct violence, as crushing injuries of the elbow, will, of course, break the coronoid process, or any other part of the elbow-joint exposed to such force; but indirect force, as a fall on the palm of the hand, may possibly fracture the process in conjunction with dislocation backwards. *Muscular*



*action*—that of the brachialis anticus—is commonly regarded as being sometimes the occasion of fracture; but the accuracy of this received opinion is doubtful; Hamilton even alleging that there is no evidence of the coronoid process having ever been broken by muscular action.

Union by ligament seems to be the mode of reparation; and in the case dissected by Sir A. Cooper, the band was so long and flexible as to allow the fragment to move upwards and downwards in the motions of flexion and extension. Bony union may occur; but, perhaps, only in fracture at the base of the process, and if, fortunately, it be unaccompanied with much displacement.

*Treatment.*—Flexure of the forearm to a right angle, is the most favourable position for union. This position may be retained by means of an angular splint, and the forearm carried in a sling, for about ten days; care being taken to prevent ankylosis by timely removal of the splint, and use of the sling alone for two or three weeks more. It has been recommended to continue the splint for a longer period; Sir A. Cooper keeping the limb immovable for three weeks, and Velpeau extending this period to four weeks.

*Compound, and Comminuted Fractures of the Elbow-joint.*—The bones which enter into the formation of this joint are liable to fracture, severally, or in conjunction. The olecranon—exposed to external violence—is more often broken; and perhaps the articular end, or the epiphysis of the humerus; or one or both condyles. Commminution of the bones occurs often extensively, and with contusion rather than laceration of the integuments. The injured joint feels like a bag of bones, crepitating under manipulation, or movements of the joint, which is singularly loose and moveable. One or two trifling wounds, at the back of the elbow, or near the condyles, communicate with this disorganized state of the joint; which results from *direct* violence. More extensive laceration of the soft parts accompanies the fracture, when occasioned by gunshot wound.

*Treatment.*—Preservation of the limb, excision, and amputation, either of which operations may be performed primarily or secondarily; have severally to be considered, as indications of treatment.

*Compound* fracture, alone, without comminution, or much laceration of the soft parts; will allow the opportunity at least, of preservation of the limb.

*Comminution* to even a considerable extent, without much injury to the soft parts; permits excision of the disorganized joint; or this operative procedure may become necessary in the event of profuse suppuration or sloughing, after either of these conditions of fracture.

*Extensive contusion or laceration* of the soft parts, in conjunction with comminution of the bones, demands amputation; or this operation may, in its turn, be unavoidable after failure of excision.

It must be confessed, at least with regard to my own experience, that the results of treatment in these conditions of injury to the elbow-joint, are seldom successful as compared with similar treatment for *disease* affecting this joint. With compound fracture, I have seldom succeeded in preserving the limb; and the failure of any attempt has been owing in this—as in similar injuries of the joints and limbs by direct violence—to the extensive subcutaneous destruction of texture, concealed probably by an almost apparently uninjured state of the integument. Pathological anatomy as shown by dissection—has corrected the shortcomings of clinical observation.

2. FRACTURE OF THE SHAFTS OF THE RADIUS AND ULNA.—Commonly occurring in the middle of the forearm or below, and rarely, above; fractures of the forearm may be of either bone alone—ulna (Fig. 118), or radius (Fig. 119), or of both bones. Usually broken transversely or

Fig. 118.



Fig. 119.



Fig. 120.



obliquely, and occasionally comminuted; displacement generally occurs, anteriorly—owing to the greater power of the flexor muscles; sometimes, however, posteriorly, laterally or angularly. (Fig. 120.)

The usual *Signs* of Fracture are present. Deformity at the seat of fracture, corresponding to the displacement; mobility, crepitus, shortening, with some alteration in the direction of the axis of the bones, or forearm below the fracture; pain, and inability to use the hand, with some loss of pronation and supination, if the radius be fractured.

*Causes.*—*Indirect* violence is, mostly, the occasion of fracture; as by a fall on the hand. Hence the radius yields more frequently than the ulna. *Direct* violence may sometimes be the cause; the middle or lower portion of the shaft being more liable to fracture than the upper portion, which is protected by a considerable thickness of muscle.

*Treatment.*—The fractured ends having been adjusted, a pad should be laid along the interosseous space, to prevent any inclination of the bones inwards; for union or ossific deposit across this space would render pronation and supination imperfect or impossible. For this reason also, the forearm should not first be bandaged *under* the splints. A long splint, extending from the bend of the elbow to the fingers, is placed on the inner aspect of the forearm and supporting the hand. A corresponding splint on the outer side, need reach only to the wrist. Both the splints should be a little broader than the arm, so that in bandaging the bones may not be compressed; a bandage is then applied from the fingers upward; and the forearm rested in a sling.

*Compound Fracture of the Forearm.*—Usually arising from *direct* violence, there may be far more extensive disorganization subcutaneously, than appears from the comparatively uninjured integument. The question of amputation will be guided, mainly, by this consideration. Otherwise, operative interference should be postponed pending the natural tendency of the injury either to recovery, or to suppurative destruction or gangrene of the limb. This latter issue is far less frequent than in similar injury of the leg; and *secondary* amputation can then be had recourse to.

3. FRACTURE OF THE LOWER END OF THE RADIUS.—Known as Colles' fracture, when situated just above the articular surface; this fracture is generally transverse; sometimes comminuted, or impacted. Displacement of both fragments occurs. (Fig. 121.) The lower or articular fragment is displaced backwards and upwards, and slightly outwards, with some degree of similar rotation on its horizontal axis; this fragment being drawn in these directions by the action of the two radial extensors of the wrist, the three extensors of the thumb, and by the supinator longus muscle; or similar displacement with impaction may occur owing to the direction of the force of fracture, when caused by a fall on the palm of the hand. The upper fragment is pronated by the pronator quadratus and teres muscles.

FIG. 121.



The *Signs* of Colles' fracture resemble those of fracture in general, but having certain peculiar characteristics in this situation. A prominence to be seen and felt at the back of the wrist, just above the joint, corresponds to the *lower* or articular fragment; immediately above which, a depression corresponds to the somewhat depressed upper end of the fracture. (Fig. 122.) The palmar

FIG. 122.



aspect of the forearm, just above the wrist, presents the opposite appearances; a marked hollow underneath the articular fragment; and immediately above, the prominence of the *upper* fragment-end, pronated by the pronator muscles, and bulging the tendons of the flexor muscles. These appearances are, of course, more marked on, or restricted to, the



radial side of the forearm; and they are most conspicuous when the forearm is viewed laterally. The hand is prone; and drawn downwards and, pronely, inwards; presenting a concavity on the radial side of the wrist, and a convexity on the ulnar side, the styloid process of the ulna projecting under the integument. Mobility of the radius above the fracture, the lower fragment not moving with it, and crepitus, both of which are elicited on rotating the bone; pain, and dropping powerlessness of the hand, with loss of pronation and supination; supply additional signs and symptoms, which further manifest the nature of the injury.

*Comminution* of the lower or articular fragment, will render some of these signs more perceptible; mobility and crepitus, in particular.

*Impaction* of the upper into the lower fragment, would render the two latter signs imperceptible, more or less entirely, according to the firmness of the impaction.

Fracture of the lower end of the ulna, with that of the radius, simulates dislocation of the wrist backwards. Mobility of the carpal fragments in connexion with any movements of the hand, and crepitus, are diagnostic of this double fracture in the vicinity of the wrist-joint.

*Causes.*—*Indirect* violence, by a fall on the *palm* of the hand, is the usual mode of fracture, thereby breaking the radius transversely within an inch above its articular surface, perhaps also comminuting this fragment; or allowing the upper fragment-end to be driven into, and impacted in it. A fall on the *back* of the hand may cause a similar fracture, but throw the lower fragment forwards instead of backwards. Such a displacement is described by Robert Smith as having occurred in one case, and Hamilton has seen another case; neither, however, were verified, as to their pathological condition, by dissection; nor is there—observes the latter authority—to be found one such specimen in any of the pathological collections in Dublin. Colles' fracture may also, it is said, be occasioned by *direct* violence. I am not acquainted with any such case.

*Treatment.*—Reduction of the displacement often requires considerable extension and counter-extension to effect it satisfactorily, not to say completely. Two splints are commonly used; a long, curved or pistol-shaped splint, extending from the elbow to the fingers, whereby the hand can be well drawn downwards to the *ulnar* side; and a short, straight splint, extending from the elbow only to the wrist. These splints may be applied; the one along the palmar surface of the forearm and hand, and the other to the dorsal surface of the forearm; or in the opposite arrangement.

Of these two plans, I prefer the former. Thus, the pistol-shaped splint, applied from the bend of the elbow along the forearm, need only extend to the fingers; and bending them over a pad at the end of the splint, gives a flexed position to the hand which is easy and comfortable. A pad corresponding to the line of the radius, betwixt the splint and forearm, will further prevent any tendency to pronation of the upper fragment; while the curved shape of the lower end of the splint, inclining the hand to the ulnar side, corrects the displacement of the lower fragment. The short, straight splint applied to the dorsal surface of the forearm, from the elbow to the wrist, affords a counter-support; and with a pad between it and the lower fragment, *directly* prevents the displacement of this portion of the bone. The splints are bandaged from

below; the hand to the curved portion of the long palmar splint, and the roller being continued upwards around both splints to the elbow. The forearm is then rested in a sling.

The opposite arrangement is Nélaton's plan of applying these splints. The pistol-shaped splint, placed on the *dorsal* surface of the forearm, extends from the elbow along the fingers; and the open hand is thus inclined by the curved portion of the splint to the ulnar side, correcting the displacement of the lower fragment. The straight, short splint, placed on the palmar surface of the forearm, extending to the wrist or only to the end of the upper fragment, and padded along its radial border, specially tends to prevent pronation of the upper fragment. A bandage is then applied as already described; and the forearm rested in a sling.

Union ensues in about a month, but rarely without some displacement; thickening and stiffness also remaining for a considerable period. Passive motion and friction should be resorted to, in anticipation of this result.

FRACTURE OF THE CARPAL, METACARPAL, BONES, AND FINGERS.—*Simple and Compound* Fractures may occur; and with the usual signs of these Injuries. Direct violence, is, probably their only cause.

The *treatment* will consist, in the adjustment of the fragments, and their retention in position upon a gutta-percha or pasteboard splint, contrived according to the fracture.

Compound fracture may require excision or amputation. But the removal of only the injured portion of the hand, should ever guide and regulate any operative interference; the hand being a most valuable member in each of its several parts, and readily recovering from most injuries.

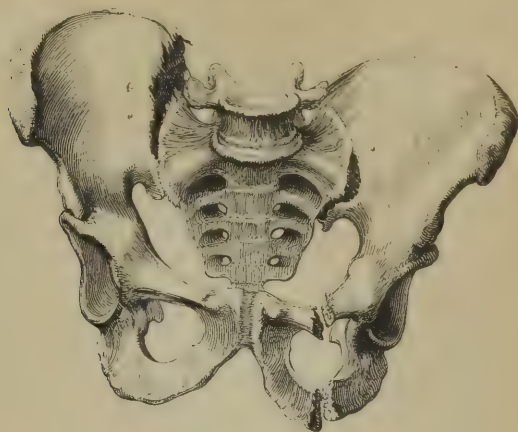
FRACTURES OF THE PELVIS.—1. FRACTURE OF THE INNOMINATE BONES.—*Structural Conditions*.—Commonly, the *rami* of the pubis and ischium are the seat of fracture; extending also, perhaps, from above the acetabulum backwards across the ilium towards the sacro-iliac articulation; or it may involve the *acetabulum*, fissuring its floor, or fracturing its margin. Sometimes, the acetabulum is comminuted, or simply divided into its three original segments, and the head of the femur driven into the pelvic cavity; or a portion of the *margin* being detached, dislocation backwards takes place. In one case, I found the pubic portion of the acetabulum nearly detached, and another fracture at the junction of the descending ramus of the pubis with the ramus of the ischium; thus nearly isolating the pubic bone. The preparation is in the Museum of the Hospital. Occasionally, some other and, perhaps, any portion, of these bones may be broken; as, for example, a rim-like piece of the *crest* of the ilium. Both innominate bones are not unfrequently fractured, and somewhat symmetrically; as, corresponding portions of the *rami* of the pubis and ischium.

Separation of the *symphysis* pubis, or of either *sacro-iliac articulation*, rarely occurs. I have, however, met with this injury to each of these *three* articulations in the same person; but only once.

Little, or no displacement is liable to occur, otherwise than by muscular action; the bones being well held together, and cushioned by soft parts. (Fig. 123.) But the pelvic viscera are frequently injured; rupture of the bladder or urethra, giving rise to extravasation of urine; laceration of the rectum sometimes occurring; or of the larger blood-vessels with intra-pelvic hæmorrhage. These visceral or internal injuries, are of far more serious import than the fracture in itself. Fractures of the pelvis

thus have an *analogous* resemblance to those of the ribs and sternum, and of the cranium or vertebral column, in regard to their visceral relations.

FIG. 123.



The *Signs* of fracture of the innominate bones are not peculiar. No irregularity of the bone at the seat of fracture may be discovered; but mobility and crepitus, on moving each half of the pelvis backwards and forwards, will be readily perceptible; pain also and inability to support the trunk are experienced by the patient on attempting to move or stand up. Inability to empty the bladder, or bloody urine, denotes some injury to this organ; and occurring with the accident, confirms the diagnosis. Caution, therefore, should always be observed in handling the pelvis, lest any visceral injury be aggravated. Fracture of, or involving, the *acetabulum*, is indicated by the crepitus elicited on rotating the femur, with the other hand placed over the trochanter. Detachment of a portion of the *margin*, with dislocation, is characterized by the recurrence of dislocation after its reduction, the head of the femur easily slipping out of the acetabular cavity.

Separation of the *symphysis*, or of the *sacro-iliac articulations*, allows of free mobility, and an interval may even be felt in the situation of such separation. In the case to which I have alluded, I could plainly pass my finger between the symphysis, and so far as to recognise the flat surface of the body of either pubis covered with its intermediate plate of fibro-cartilage. The transverse or connecting fibres had given way, as well as the ligaments on each aspect of the symphysis, including the strong *sub-pubic* ligament.

*Causes.*—*Direct* violence is almost the only cause of fracture of the pelvis. A heavy fall, or a crushing compression of the innominate bones, as by a cart-wheel passing over the pelvis, or the force of a squeeze between the buffers of two railway carriages; such, and similar accidents, are the ordinary occasions of these injuries; or they result from the equally formidable contusion of gunshot wounds. *Indirect* violence sometimes produces fracture of the pelvis; as of the acetabulum, when a person falls from a height and alights on his feet. Force applied from



the back may have the same effect; an instance of which is cited by Hamilton—a man æt. twenty-seven, on whose back a number of bricks had fallen while his right knee rested on the bank of a trench. Death ensued in a few days; and a fracture was found extending through the bottom of the right acetabulum, and about one inch and a half of the rim at its upper and posterior margin was completely detached, otherwise than as being retained by a portion of the capsular ligament. Dislocation upwards and backwards could be readily reproduced to and fro. The femur was not broken. Falls on the hip, striking the great trochanter, are perhaps the most common occasion of fractured acetabulum; the force then being transmitted more directly.

*Course and Terminations.*—Union of the fracture takes place generally without difficulty, resulting only in some degree of lameness. This result occurs more frequently in fracture of the acetabulum, with dislocation owing to the nature of the injury not having been detected, or the impossibility of maintaining reduction. Permanent lameness ensues. But any visceral injuries are of more serious or fatal consequence. The chief difference in such cases depends on the situation of the injury; whether, or not, laceration of the bladder opens into the peritoneal cavity, with extravasation of urine internally or externally. In the one case, death is almost inevitable; in the other, urinary infiltration behind or in front of the deep perineal fascia, will be followed by suppuration and sloughing, perilous to life.

*Treatment.*—Any visceral injury demands immediate attention. A catheter should be introduced to discover the state of the bladder. If bloody urine, or other symptoms of injury to this organ or the urethra be present, the catheter must be kept in the bladder, to prevent extravasation of urine. In the event of extravasation occurring externally, early and free incisions into the scrotum may avert the full extent of the local mischief, and the consequent typhoid disorder. But the treatment of such Extravasation of Urine is described in a subsequent chapter. The fracture itself requires comparatively little surgical manipulation. The pelvis should be bound round with a broad roller, or rib-bandage, and the patient laid recumbent at rest on a flat bed or mattress, sufficiently firm to counteract any tendency to displacement. Fracture of the acetabulum must be further secured by means of a long splint, or a hip-splint of gutta-percha, moulded to the side of the pelvis and thigh, to fix the joint.

2. FRACTURE OF THE SACRUM.—Exceedingly rare, fracture of the sacrum may, however, occur in conjunction with that of the innominate bones. The fracture then takes place at any part of the sacrum, and in any direction; but it may happen independently, and then generally below the sacro-iliac articulation, and transversely across the bone. In this condition, displacement is almost invariably the same; the coccygeal extremity being carried forwards, without probably interfering with the rectum or anus. A slight lateral deviation is sometimes produced.

The *Signs* are; an angular projection backwards at the line of fracture, and corresponding to the displacement forwards, mobility and some crepitus; with pain, greatly aggravated in any attempt to bend or elevate the body, and especially acute in any efforts at defecation.

*Causes.*—Fracture of the Sacrum arises from the same causes as that of the innominate bones; and from blows or falls on the sacrum itself, in fracture transversely below the sacro-iliac articulation.

*Course and Termination.*—If fracture of the sacrum occur in conjunction with fracture of the innominate bones, the accompanying lesions of the pelvic viscera generally prove fatal. Fracture of the sacrum alone is generally followed by a speedy recovery, although the inward displacement cannot often be completely overcome.

*Treatment.*—The displacement may be corrected by passing a finger into the rectum and pressing back the coccygeal portion of the sacrum; but great difficulty will often be experienced in retaining it there. Various contrivances have been resorted to for this purpose, such as the introduction of a wooden cylinder, or other form of compress, within the bowel. Any such body must be removed every two or three days, and an enema administered. A roller drawn firmly around the pelvis, and the support of a flat, resisting mattress, ensures the rest requisite for union. This takes place in about a month, or a shorter period, according to the less frequent disturbance of the part by the act of defæcation. Thus, in a case under Bermond's management, the rectal plug was retained without much inconvenience nineteen days, having been only once removed during that period; and union was then firm.

FRACTURE OF THE COCCYX occurs but seldom. The structural conditions, signs, causes, and treatment, are the same as in fracture of the coccygeal portion of the sacrum. The pain and inconvenience may be very persistent, after the injury itself is repaired. The sitting posture will then be made more tolerable or comfortable, by wearing a pad on each tuberosity of the ischium. A horseshoe-shaped air-cushion will also give great relief, as I have known in cases of *coccydynia*, a painful or neuralgic affection of the coccyx.

FRACTURES OF THE FEMUR.—Like other long bones, fractures of the thigh-bone may occur, in its Upper Articular end, the Shaft, or the Lower Articular end.

FRACTURES OF THE UPPER ARTICULAR END, comprise those of the Neck, within, or outside, the Capsule, and of the Trochanter alone.

Fig. 124.



(1) INTRA-CAPSULAR FRACTURE OF THE NECK OF THE FEMUR.—*Structural conditions.*—In *direction*, intra-capsular fracture of the neck of the femur, is,

generally, somewhat oblique—from above downwards and outwards, including sometimes a portion of the head; occasionally, it is quite transverse. The *capsule* and *periosteum* are generally rent asunder incompletely, but sometimes completely. *Displacement* of the two fragments usually occurs; the lower fragment, continuous with the shaft of the bone, is drawn upwards and to the outer side of the head of the bone, and rotated so that the fractured end is directed forwards (Fig. 124). The upper or articular fragment remains in position; the head of the bone being in the acetabulum, and connected by the round ligament. Displacement of the lower fragment

will be more or less complete, according to the extent of rupture of the capsule and periosteum.

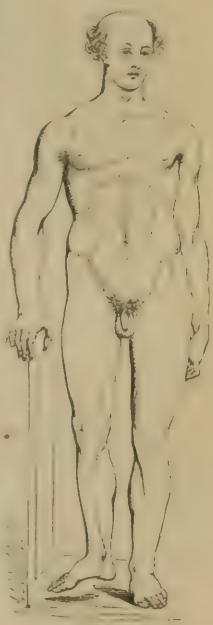
*Impacted fracture* may occur, the end of the lower fragment being driven into the upper fragment.

*Signs.*—In intra-capsular fracture of the neck of the femur, the limb is shortened, and everted; with the knee slightly flexed, the toes pointing outwards, and the heel drawn up and resting on the inner side of the leg above the ankle. (Fig. 125.) The hip is somewhat flattened, the prominence of the great trochanter being less marked, and drawn upwards to the anterior superior spine of the ilium. Thus far, the injury resembles dislocation forwards upon the pubes; excepting that the limb is then abducted, and the head of the bone can generally be felt in its new position. But, with fracture, on drawing the limb downwards to its proper length, and rotating inwards, crepitus and mobility of the lower fragment will be felt, when the hand is placed over the trochanter; and this prominence of bone moves in a less regular and smaller segment of a circle than on the opposite or sound side. Pain, severe on any attempt at motion, and total powerlessness of the limb, conclude the diagnosis. *Shortening*, in the first instance, varies, from half an inch to an inch; but it increases, perhaps, to two inches or more, as the capsular ligament yields more completely, or the fragments impacted become dislodged. *Eversion* is produced, partly by the action of the external rotator muscles inserted into the great trochanter, and partly or principally, as the natural position into which the lower limb falls when left to itself. *Inversion* sometimes occurs, but very rarely; and is owing, probably, to the action of the adductor muscles, aided by some partial rent of the capsular ligament, favouring such muscular action. Thus, if the inner side of the capsule remain entire, this, it has been supposed, would facilitate inversion; but, it seems to me that a rent of the inner side of this ligament, would be more conducive to inward rotation of the femur. Dissection in cases of inversion, is wanted to establish either opinion. The position of the lower fragment in front of the upper one, is the explanation urged by Dr. R. W. Smith. Neither eversion nor inversion of the foot may be present, according to Hamilton, in some cases; the toes pointing directly forwards.

*Impacted fracture* is denoted by an absence, or minor degree of all the signs, except shortening. Some degree of shortening of the lower limb, which cannot be extended to its original length; unaccompanied by the other signs of fracture—or dislocation—and immediately consequent on some occasion of injury; is diagnostic of fracture having occurred, with impaction of the fragments,—an impacted fracture. A well-marked case of this kind, which was under my care in the Hospital, is reported in the Medical Times and Gazette, 1866.

*Causes.*—*Indirect violence*, but of so slight a character in many cases, as scarcely to exceed a stumble; will, generally, be found the only exter-

FIG. 125.





nal cause to which intra-capsular fracture of the neck of the femur can be referred. A slight trip of the foot, slip, or mis-step in going down stairs; are the usual occasions of this fracture. But, *age* very much *predisposes* to the injury. It seldom happens in persons under fifty; and the predisposing condition consists of an alteration in the structure, and

FIG. 126.



FIG. 127.



consequent direction of the neck of the femur, thence favouring the occurrence of fracture in this portion of the bone. Its cancellous and compact texture having undergone fatty degeneration, or disintegration and *atrophy* (Fig. 126), the neck gradually yields to the weight of the body; the inferior border of the neck, originally the longest, thus becomes somewhat shortened, and the whole neck drops to nearly a *right angle* with the shaft. (Fig. 127.) This horizontal direction, in particular, renders the neck less able to sustain the shock of any force transmitted through the femur, and which throws the weight of the trunk suddenly, on this portion of the bone. It snaps instantly and easily—perhaps, almost imperceptibly. Besides the predisposition of advancing life, intra-capsular fracture of the neck of the femur is said to occur more frequently in women than in men.

FIG. 128.



Union by *ligament* ensues, as the only mode of reparation in most cases (Fig. 128); or *no* union may take place, a false ball-and-socket joint forming between the ends of the two fragments. *Bony* union, at one time

Union by *ligament* ensues, as the only mode of reparation in most cases (Fig. 128); or *no* union may take place, a false ball-and-socket joint forming between the ends of the two fragments. *Bony* union, at one time

and for many years, thought never to take place, does assuredly result in some rare cases; but only, it would seem, when the capsular ligament remains entire, or the fragments impacted, whereby a due supply of blood can be speedily established.

The use of the limb is not restored under three or four months.

*Treatment.*—No bony union taking place, as the rule, in intra-capsular fracture of the neck of the femur; it will generally be useless to adjust the fracture and apply any retentive apparatus, with a view to such union; and the more so, in proportion to the years of the patient. In elderly persons, and those to whom any long confinement would be prejudicial; their general health is of more consequence than the fracture, and which is itself irreparable in advanced life.

The limb may be placed in an easy position, until pain, and the inflammatory consequences of the injury have subsided; when a splint moulded to the hip should be applied, and the limb slung from the foot by a long band passing round the neck; the patient thus being enabled to get about on crutches. Whatever reparation, and recovery from lameness, may then take place, it proceeds under the most favourable circumstances with regard to the general health, and its influence on reparation.

In younger subjects; the fracture may be adjusted, and a long splint applied, as for the treatment of other fractures of the femur.

*Impacted fracture* should be treated in the same way; but the splint is applied only for retention, as the limb cannot be extended to its original length.

## (2) EXTRA-CAPSULAR FRACTURE OF THE NECK OF THE FEMUR.—*Structural Conditions.*—In situation, extra-

capsular fracture may occur at any part of the neck external to the capsule; but generally, at the base, corresponding very nearly with the anterior and posterior inter-trochanteric lines. *Comminution* almost invariably occurs; and, probably, by the penetration of the upper fragment into the trochanteric fragment, so as to split it into two or more pieces. The *direction* of the fracture in the outer fragments, is also remarkably uniform; the great trochanter usually being divided from near the centre of its summit, obliquely downwards and forwards towards its base, and the line of fracture terminating a little short of the small trochanter or penetrating beneath its base; one or two lines also usually traverse the great trochanter, horizontally. In more than twenty specimens — observes Hamilton — there were only two or three exceptions to these general rules.

*Impacted fracture* is produced,

FIG. 129.



when the upper fragment is driven into, and partly imbedded in, the trochanteric fragment; the compact portion of which embraces, and fixes, the neck of the femur, thus shortened and slid down nearly to a right angle (Fig. 129).

The *Signs* of extra-capsular, are the same as those of intra-capsular fracture, but *more marked*. Thus, shortening, averaging one inch and a quarter—in 42 cases—may reach to two, three, and even four inches. Eversion is very conspicuous, but inversion not uncommon as compared with intra-capsular fracture. Flattening of the hip is also well marked, unless swelling, which is often considerable, has supervened. Crepitus and mobility are equally notable; and these three hip-signs, are even more pronounced with *comminuted* fracture. Pain, always severe, and total inability to move the joint, will no less attract the notice of the Surgeon.

*Impacted* fracture renders all these signs obscure or imperceptible, except shortening, which varies from half an inch to an inch. The limb cannot be extended to its original length.

*Causes*.—*Direct* violence, as by a fall on the hip, is the usual mode of fracture; occasionally, *indirect* force, as by a fall upon the feet or knees. Age has less *predisposing* influence than with relation to intra-capsular fracture. Extra-capsular fracture is said to occur mostly between the ages of thirty and forty; but Hamilton regards the liability as proportionate to advancing life, and that age may be considered as the “grand predisposing cause.” Both sexes seem equally liable.

FIG. 130.\*



*Union by bone* takes place readily, and especially with an impacted fracture. (Fig. 130.) The callus is deposited, almost invariably, along the inter-trochanteric lines; and also, not unfrequently, along the lines of the other fractures of the trochanter. This callus is abundant and irregular, projecting as spines and tuberosities; forming a knobby and spiculated crown, which embraces the upper fragment. Osseous buttresses sometimes reach even to the bones of the pelvis. The use of the limb may be restored in six or eight weeks; but lameness still continues, and with impacted fracture, this condition is permanent.

Comparing fractures of the neck of the femur, within and without the capsule; it will be seen that they differ, in their structural conditions, in the degree of their signs, in their causes, and prognosis.

*Treatment*.—Moderate extension and rest, by means of the long straight splint, is here the most appropriate mode of treatment. A bandage or padded belt may be applied around the pelvis, underneath the splint, to retain the trochanter, often comminuted, in position. The only objection

\* Intra-capsular and extra-capsular fractures of the neck of the femur; the former not united, the latter firmly united by bone. (Langstaff.)



I have ever experienced in the use of this retentive apparatus, has been, not as to its thorough efficiency, but the pain occasioned by pressure over the trochanter, owing to the contused state of the integuments in most cases. This inconvenience, however, is temporary, and can be overcome by using an *interrupted splint*.

*Impacted fracture* should be treated in the same way; although the splint must be applied only for retention, as the limb cannot be extended to its original length.

(3) FRACTURE THROUGH THE GREAT TROCHANTER.—The *direction* of fracture through the great trochanter, is a line passing obliquely upwards and outwards from the lower portion of the neck, but instead of traversing the neck completely, it passes through the base of the great trochanter, thus separating the femur into two fragments; an upper consisting of the head, neck, and great trochanter; and a lower, the shaft of the femur (Fig. 131). This fracture occurs very rarely, and it has been verified by dissection in only two cases; the one related by Sir Astley Cooper, the other by Mr. Stanley. The signs, causes, prognosis and treatment, are the same as in extra-capsular fracture of the neck.

FIG. 131.\*



*Compound fracture of the neck of the Femur*, is a very formidable injury, resulting almost exclusively from gunshot wound.

The *Treatment* is that for compound fracture, in general; hence, according to the condition of injury, retentive appliances may be used, excision of the splintered portion, or amputation at the hip, resorted to. But, experience has shown that any attempt to preserve the limb entire will be almost hopeless; and amputation, utterly hopeless; excision, therefore, remains as the only justifiable resource, followed by retention of the limb in the best position for union.

FRACTURE OF THE SHAFT OF THE FEMUR.—*Structural Conditions*.—The *situation* of fracture is, generally, in the middle third of the shaft; its *direction*, oblique downwards and inwards, or downwards and forwards in the lower third, and varying in the upper third; transverse in children; or the bone may be not unfrequently comminuted. *Displacement* of the lower fragment occurs, upwards and inwards, somewhat behind the upper fragment, and with some rotation outwards. This displacement is produced by the adductor muscles. The upper fragment is drawn or tilted forwards by the conjoint psoas and iliacus muscles, inserted into the small trochanter; and outwards by the external rotators. (See Fig. 87.)

This state of the fragments as pertaining to the middle third of the bone, existed in a case which I examined within a few hours after the

\* The line of fracture in the figure nearly coincides with the description in the text. (Sir A. Cooper.)

accident; it having then proved fatal. The preparation is in the Museum of the Royal Free Hospital.

The *Signs* of oblique fracture in the shaft, are; deformity of the thigh, corresponding to the displacement, and occasioning a muscular fulness on the inner, and less so on the outer aspect of the thigh; mobility, and crepitus, on extending and rotating the limb; shortening, to about one inch, but increasing with muscular action, and some eversion; pain, and inability to use the limb. *Transverse* fracture, in children, is accompanied with *angular* deformity; the ends of the fragments being incompletely displaced, and hitching on each other. The other signs are the same, differing only in degree from those of oblique fracture in the adult. These signs are usually so well marked, and especially those connected with the seat of fracture, that the nature of the injury can hardly be overlooked, and may be suspected at a glance. It is thus also that fracture in the *shaft* of any bone is always more readily detected than at either articular end; and where the diagnosis of the two or three fractures there liable to occur, is even more difficult.

*Causes.*—*Direct* violence undoubtedly may be regarded as almost the only mode of fracture in any portion of the shaft; unless it has occurred immediately above the condyles or immediately below the small trochanter. Thus, the passage of a loaded vehicle across the thigh, or the fall of a piece of timber directly on it, represent the occasions of fracture. *Indirect* violence, as a fall on the feet or an indirect blow, may, indeed, fracture the shaft; but, more commonly, the bone just above the condyles, or just below the small trochanter.

*Union by bone* takes place, usually, in the course of about six weeks or two months; but rarely, if ever, without some overlapping of the fragments and proportionate shortening of the limb.

*Treatment.*—Many plans of treatment have been devised, and very many forms of retentive apparatus contrived, for the treatment of fractures of the Femur.

The *long, straight splint* will be found most effectual in *all* fractures of this bone; excepting, probably, fracture near the small trochanter above, or near the condyles below; in the former of which, the upper fragment is much tilted forwards and outwards by the conjoined psoas and iliacus and by the external rotator muscles; and in the latter, the lower fragment is much drawn backwards by the gastrocnemius. As means of *extension*, the long splint must exceed the length of the limb, by five or six inches beyond the sole of the foot; while for steady *retention*, the splint should reach from near the axilla along the side of the chest and limb, to that point. These requisites are best combined in Liston's long splint; which, with a perineal band, for counter-extension, should be thus applied. (See Fig. 92.) The split ends of a roller are tied to the upper end of the splint, through two holes, and well secured; the roller is then drawn down on the inner aspect of the splint, and overlaid by a pad the breadth and length of the splint, to the foot, the pad being kept in position by a few tapes, binding it, at intervals, to the splint. Having well adjusted the padded-splint from the axilla to the foot; the roller, running between, should be drawn round the foot, across the instep, and round the end of the splint, where it is received into deep notches, with an intervening point to catch the roller; then drawn round the foot again, and so on in a figure-of-8 fashion. The foot having been thus secured to the end of the splint, as the point of extension, the roller is continued up the

limb to below the seat of fracture in the thigh; a perineal band, consisting of a handkerchief covered with oil-silk, should now be passed from the inner side of the thigh around the buttock, drawn well up into the crutch, and the ends passed through the two holes at the top of the splint. By tightening this band, the limb can be extended from below the fracture, and its adjustment having thus been completed, the ends of the perineal band are secured at the top of the splint. The roller is continued up the thigh, and around the chest and splint nearly to the axilla; further securing both fragments in position, through the medium of the unyielding splint.

The only difficulty likely to arise in the course of treatment by the long splint, is some excoriation occasionally, from the perineal band. A little temporary relaxation of the band, powdering the surface with flour or chalk, or the maintenance of extension by a weight pendent from the lower end of the splint; will usually succeed in overcoming this difficulty. In the management of a very large number of cases of fracture of the thigh, by means of the long splint and perineal band, I have never experienced any other difficulty, nor has that ever proved insuperable; while the perfect efficiency of this plan of treatment has been attested by the most satisfactory results.

Fracture of the shaft of the femur *near the small trochanter* may sometimes be adjusted more evenly—by *relaxation of the muscles*, and the application of a splint to maintain the requisite position for that purpose. The thigh is flexed on the abdomen, and the leg upon the thigh, and the limb laid somewhat on its outer side; an *angular splint* moulded to the hip and thigh, must then be applied, and, perhaps, a short counter-splint on the inner aspect of the thigh. Both are secured by a bandage.

Fracture *near the condyles*, in the *shaft*, may be conveniently associated with that of the lower articular end.

**FRACTURE OF THE LOWER ARTICULAR END OF THE FEMUR.**—The *direction* of fracture is, generally, transverse; or either condyle may be detached; thus resembling fractures of the Lower Articular End of the Humerus. These fractures also involve, or extend into, the knee-joint. *Displacement* of the lower fragment backwards is produced by the action of the gastrocnemius muscle.

The *Signs* are, usually, clearly perceptible; some deformity corresponding to the displacement, mobility, and crepitus; pain, and loss of power in proportion to the displacement.

*Impacted* fracture in this situation is liable to occur. Erichsen states that he has had several such cases under his care. In one, the upper fragment, which was very oblique, was firmly driven into the cancellous structure of the lower one. In another case, the condyles of both thigh-bones were splintered or comminuted into a number of fragments, amongst which the shafts were impacted.

*Causes.*—*Indirect* violence, as by a fall on the feet, and thence fracture of the epiphysis—transversely from the shaft, is not uncommon in children. *Direct* violence, as by a fall on the knee, or kick of a horse, may fracture either condyle.

*Union* by bone commonly takes place; and, indeed, such was the result in the more severe cases above noticed.

*Treatment.*—A *flexed position of the knee*, supported by the *double-inclined plane* or McIntyre splint, is perhaps the most effectual plan of treatment in these fractures. Inflammatory swelling of the knee-joint—



concomitant with fracture near or into the joint—must be subdued by cold lotions or irrigation.

The *starched* bandage will be appropriate in the treatment of *any* fracture of the femur—as in all other Fractures—only when retention, without any extending force, may be sufficient. It will, therefore, be found very useful after consolidation has taken place, to thus finish off the union, without further confinement to bed. Or, it may be employed from the commencement, in children and infants; where the ordinary apparatus cannot well be applied or retained. In adults as well as children, for the treatment of fractures of the thigh; Mr. Erichsen extols the starched bandage, as being suitable, in most cases, from the commencement. He has thus treated “many fractured thighs, both in adults and children, without confinement to bed for more than three or four days, and without the slightest shortening or deformity being left.” I must confess to never having been so fortunate in a single instance. In the last case where I removed the long splint, and put up the limb in a starched bandage, earlier than usual—i.e. before consolidation of the callus; the upper fragment progressively overlapped, occasioning acute pain, and the man had to go to bed again for another month.

COMPOUND FRACTURE OF THE FEMUR—often comminuted; results, usually, from direct violence, as severe contusion or gunshot injury.

*Treatment.*—The rules of treatment for Compound Fracture in general are here applicable; whether with regard to preservation of the limb, intact, excision of splintered portions of bone, or amputation. The amount of concomitant injury to the soft parts—integument, cellular texture, muscles, vessels and nerves, as well as the fracture itself; mainly determines these questions of treatment.

For *preservation* of the limb, by reparation of the fracture; a long splint should be applied, as for simple fracture; the splint however, being “interrupted” opposite the fracture, to facilitate the application of dressings. *Excision* might possibly be the means of preserving the limb, short of the comminuted or splintered portions of bone removed. But I have not met with a case as regards compound fracture of the *femur*; though I have myself succeeded in thus preserving the leg in compound fracture of both the tibia and fibula. *Amputation* may prove successful in the middle third of the thigh, but never at the hip-joint. If therefore, the fracture be so high up as to render it doubtful whether amputation in the former situation should be performed, or an attempt made to preserve the limb; the Surgeon must use his own judgment in steering between Scylla and Charybdis. In a recent case of this kind, I was compelled to have recourse to amputation at the hip, owing to the shattered state of the limb, and the persistent dribbling hæmorrhage in spite of tourniquet compression. The patient, as usual, died in a few hours.

Compound fracture, involving the *knee-joint*, necessitates amputation.

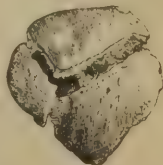
#### FRACTURE OF THE PATELLA.—

*Structural condition.*—In fracture of the patella, the line of fracture is generally transverse, and across the middle (Fig. 132), or sometimes the upper rim only of the bone. Longitudinal fracture may occur; or comminution more frequently, the bone being starred

FIG. 132.



FIG. 133.



and broken into three tolerably equal pieces (Fig. 133). Laceration and opening of the synovial capsule has been known to accompany simple fracture, as shown by a specimen in the Museum of the Royal Free Hospital. Displacement of the upper fragment, upwards, is produced by contraction of the quadriceps extensor muscle; the lower fragment fixed by the ligamentum patellæ, remaining stationary.

The *Signs* of fracture are sufficiently obvious; a depression or interval, into which the finger readily sinks, between the two fragments, and more perceptibly when the joint is flexed; mobility of the fragments, and probably some crepitus, when the limb is extended. Pain may be inconsiderable, but marked inability to raise the limb, in addition to the above signs, can never be overlooked (Fig. 134). Fracture of just the upper *rim*, without any rupture of the aponeurotic capsule of the joint, will probably render these signs obscure. In one such case, the patella seemed to me of the usual shape and size; no interval could be detected, the small crest-piece of bone not being drawn upwards, but slipping behind the patella, itself apparently entire; and thus the fragment could not be readily moved laterally, nor brought into contact with the rest of the bone. But, there was the usual powerlessness, or nearly so, in the patient's endeavour to lift his leg.

FIG. 134.



*Causes.*—*Muscular action* is the most frequent cause, producing transverse fracture. A person falls backwards, the knee is bent, and the patella snaps—as the tendon of the quadriceps extensor might be ruptured—by the sudden strain thrown on that muscle in the effort to regain the upright posture. But the fall ensues because the patella gives way, and the bone is not broken by falling on it. Consequently, this accident happens more commonly in men, and in adult life than childhood. In like manner, after fracture of one patella, the other is more liable to be broken by muscular action; increased strain being thrown on the quadriceps muscle of the other leg, in any similar effort of self-preservation. Both patellæ have been known to snap simultaneously. *Direct violence*, as by a fall on the knee, is the occasion of longitudinal, and, more especially, of comminuted fracture. According to Hamilton, such force will generally produce transverse fracture; but muscular action invariably having this effect, the greater proportion, if not all, transverse fractures, are thus produced.

The mode of *union* in fracture of the patella would appear to be of two kinds; ligamentous, (Fig. 135), and osseous; the difference depending probably on the less or more complete contact of the fragments, during the process of union. Hence the probability as to the one or the other taking place will vary according to the direction of the line or lines of fracture, whereby the fragments are subjected to displacement by muscular action—that of the quadriceps extensor, or perhaps by an altered position of the limb. *Ligamentous* union usually takes place in trans-

verse fracture; with rare exceptions, where osseous union may occur, nearly complete contact having been maintained. Union by ligament will form even when separation of the fragments extends to an inch and a half; beyond this distance, thickened aponeurotic fascia serves as the only bond of connexion. Thus the fragments may remain severed to an extent of four or five inches. *Osseous* union, apparently, takes place more frequently in longitudinal, and in comminuted fractures of the

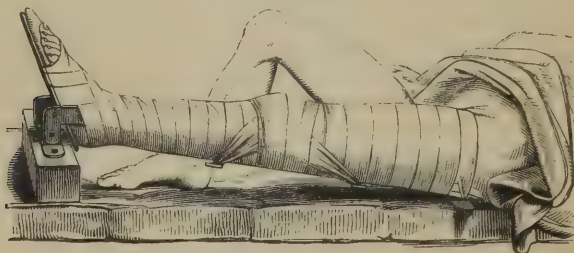
Fig. 135.



verse fracture, marked E. A. (594), in the Museum of the Royal College of Surgeons, Dublin. Necrosis of the patella may ensue, after transverse fracture with ligamentous union; owing apparently to deficient vascular supply to the fragment affected. The upper fragment became partially necrosed, in a case recorded by Erichsen.

*Treatment.*—Position of the limb, so as by relaxation of the quadriceps extensor muscle, to bring the fragments into close apposition, is the guiding rule of treatment. The limb should be extended, and flexed on the abdomen, until the fragments would naturally fall into apposition, and this position maintained by a sufficiently elevated inclined plane on which the limb rests. Any swelling or distension of the synovial capsule

Fig. 136.



—any synovitis, consequent on the injury, having subsided, aided by an evaporating lotion; the fragments may then even be brought into contact. When, therefore, the swelling has diminished in the course of three or four days, during which period no reparation could have commenced; the fragments may be readily, and painlessly, retained in position



by the application of a bandage immediately above and below them, encircling the limb in a slightly figure-of-8 form, and tied together at the sides (Fig. 136). Sometimes the additional security of a compress just above the upper fragment may be necessary. A short back splint from above the ham to the calf, and furnished with a hook above and below to catch the turns of bandage, will further steady the fragments. The bandage should be tightened daily as the swelling subsides. Broad strips of plaster, overlapping each other, might be used instead of the bandage, but this retentive appliance cannot be tightened without re-application and disturbance of the fragments.

Various other apparatus have been contrived, but they are all alike in principle, and none of them succeed in bringing about union better than the above described.

Malgaigne's *hooks* are a contrivance whereby the fragments can be forcibly drawn together, and retained, by steel claws thrust into them, or just above and below them. If there be no risk of penetrating the joint with this instrument, violent synovitis is not unfrequently induced. I have never used the clamp in my own practice; but in one case particularly, having been asked by a surgeon to see a fractured patella which was subjected to its grasp, I found a huge globular knee, pierced by the claws of the instrument, and surrounded by a gutter of pus. Nor is this instrument necessary, if the position of relaxation be duly observed. Malgaigne, I learn from Mr. W. Adams, has used the hooks in only 14 cases out of a large number of fractured patellæ; exceptional cases, attended with unusually wide separation of the fragments.

Comparing the two retentive appliances, it may be fairly said, that the bandage in a moderately figure-of-8 form, is at least equally efficacious, and invariably safe; whereas, the hooks are unnecessary, and not unfrequently perilous.

With the simple, efficacious and safe plan of treatment I have described, *union* will be so far secure in a month or six weeks, as to allow the patient to move about; guarded by a back splint and starched-bandage. It is not advisable to have recourse to this substitute-apparatus at an earlier period; simply because the yielding ligamentous union should not be strained by any muscular action in using the limb, or the chance of osseous union be frustrated. Even after some six weeks have elapsed, the ligamentous band continues to yield; and in the course of as many months may present an interval between the fragments of several inches. For *permanent* support, I have used with advantage another simple contrivance—a laced elastic knee-cap, having a leathern receptacle to compress the patella. In one case, a gentleman, of powerful muscular development and accustomed to a sporting life, was thus enabled to go about, without any further separation of the fragments. This apparatus should be worn until the union has become firm and unyielding.

The *union-results* of this mode of treatment—by position and bandage-retention—have been, in my own practice at least, most satisfactory. In four cases, selected as having been authenticated by notes carefully taken by Mr. John B. Foster, formerly House Surgeon at the Royal Free Hospital, the principal points of interest and importance were the following:—(1) The fracture in all four cases was transverse, and occurred in the left patella. (2) Three of the fractures were caused by muscular action, the fourth by direct violence. (3) The ages of the patients were fifty-six, forty-nine, forty, thirty-three. (4) The periods when union

was found to be firm, and the support of a back splint in starch used only as a precaution, were ten weeks, six weeks, eight weeks, six weeks. (5) The extent of separation between the fragments, originally, and at the end of these periods, was as follows:—Original separation, in all the cases, two inches, slightly more or less. Union-separation, one-fourth of an inch, contact, one-fourth of an inch, one-eighth of an inch.\*

*Compound fracture of the patella rarely occurs alone. It is almost necessarily comminuted, with great injury to the joint; and results from direct violence of severe character, as some crushing force, or gunshot wound.*

The treatment will generally be amputation, without delay.

**FRACTURES OF THE LEG.—1. FRACTURE OF THE TIBIA AND FIBULA, OR OF EITHER BONE SINGLY.**—*Structural Conditions.*—The direction of fracture in the tibia and fibula is most

FIG. 137.

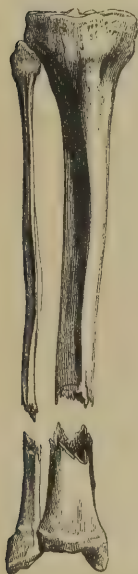


FIG. 138.



commonly transverse, in the upper part of these bones, especially the tibia; or it may be comminuted, and extend into the knee-joint; in the lower part, the fracture is commonly oblique, or transverse (Fig. 137); or perhaps less frequently comminuted. These differences are dependent on the causes of fracture, above and below. *Displacement* varies with the line of fracture. Angular displacement usually occurs with transverse fracture, the ends of bone remaining, partly at least, in contact. This displacement is produced by the flexor muscles of the calf drawing the bones backwards, aided by the weight of the leg, and perhaps the tilting forwards of the ends of the upper fragments by the quadriceps extensor, inserted into the tubercle of the tibia. Longitudinal displacement, with oblique fracture, is produced by the muscles of the calf drawing the lower fragments backwards and upwards. Rotatory displacement of the lower fragments may

be occasioned by inversion or eversion of the foot.

Fracture of the tibia (Fig. 138) or fibula, *singly*, is attended with less displacement; either bone acting as a splint to the other, and especially the massive tibia in relation to the fibula.

*Signs.*—The signs with fracture of *both* bones are most marked. Deformity is presented corresponding with displacement; an angular projection forwards, will be observed, usually in transverse fracture, high up; a depression on the subcutaneous surface of the tibia, in oblique fracture, lower down. Mobility and crepitus are easily produced on handling the fragments; and the outline of the leg is seen to be altered, the axis of the bones above and below the seat of fracture, forming an angle; with some shortening also in oblique fracture. Pain, as in other

\* Summary of a Paper read before the Harveian Society, London.

fractures, is occasioned by any movement, and marked powerlessness of the limb cannot be overlooked; the leg can be moved about loosely as a flail below the fracture, and lies helpless in any position in which it is placed.

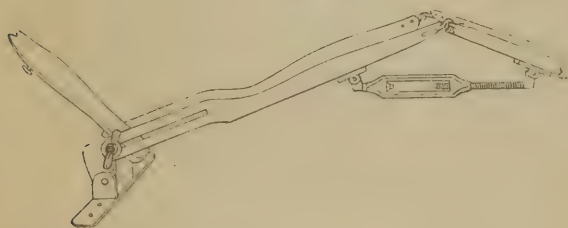
Fracture of the tibia or fibula, *singly*, is attended with the same signs, but less pronounced than in the case of both bones; the sound bone, supporting the fractured bone. Fracture of the *tibia* presents the more obvious signs. On tracing down the bone, some irregularity will be discovered, and some mobility and crepitus of the fragments may be elicited. Fracture of the *fibula* in its upper two-thirds, is obscured by the peronic muscles which overlay the bone in this portion of its extent. By following the fibula with the finger, from below upwards, the signs of fracture may be rendered perceptible.

*Causes.*—*Direct* violence seems to be the only cause of fracture of these bones in their upper part. Any crushing compression, as by a wheel passing over the leg, or a jam between the buffers of railway carriages, may thus be the occasion of fracture; both bones being broken at the same height, and transversely or comminuted. Gunshot injury acts in like manner. *Indirect* violence is, probably, the more common cause of fracture lower down. A fall or leap from a height, the person alighting on his feet, breaks the tibia obliquely; and the fibula next sustaining the shock, gives way. Fracture thus seldom occurs at the same height in both bones; either bone yields at its weakest point, the tibia about the junction of its lower third, the fibula near its upper end.

*Union* by bone usually takes place in about six weeks or two months; in fracture of the fibula, a shorter period.

*Treatment.*—The fragments having been brought into apposition by moderate extension, aided by sufficient flexion of the knee, and of the thigh on the abdomen; the leg may be laid in a McIntyre's double inclined-plane splint, or that apparatus as modified by Mr. Liston (Fig. 139.) This position of the limb overcomes displacement of the upper and lower fragments, as resulting from muscular action; but displacement of the lower fragment, owing to any dropping of the leg, is still further coun-

FIG. 139.

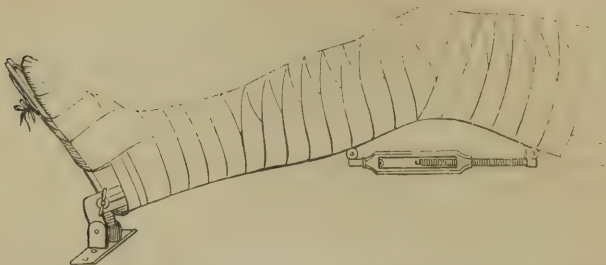


teracted by supporting the foot in a short sock with a tape attached to the toe, which is thus secured to a brass button over the end of the foot-piece of the splint. A roller is then applied around the foot and this portion of the splint to maintain extension, and continued around the leg and splint, upwards to the lower part of the thigh. McIntyre's double-inclined plane may be *fixed* by screwing the end to a vertical iron support, and which is attached to a flat board, itself placed under-



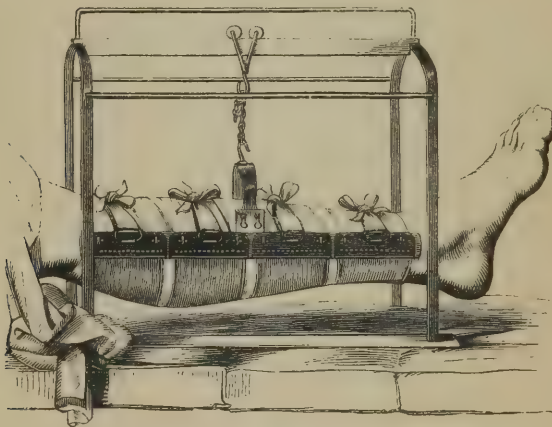
neath the mattress of the bed on which the patient lies (Fig. 140). A more comfortable arrangement, and equally efficacious, in relation to

FIG. 140.



the union of fracture, is to suspend and swing the splint in a framework contrived for this purpose, as in Salter's swing apparatus (Fig. 141).

FIG. 141.

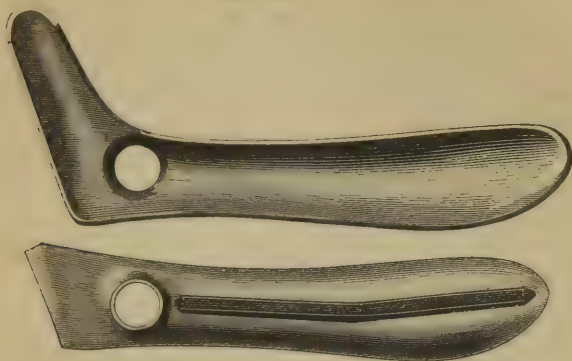


Various other apparatus have been designed for the adjustment of fractures of the leg. A fracture box, consisting of three splints,—a leg-rest, and two supporting side-pieces (Fig. 142), may be used and swung as a McIntyre's splint. But I have never experienced any difficulty or unsatisfactory result, which could be fairly attributed to that splint, in the treatment of ordinary fractures of the leg. Fracture, very oblique, or comminuted, may, indeed, occasion some difficulty as to the retention of the fragments in apposition. It is here that division of the tendo-Achillis seems a justifiable procedure, with the view of correcting the displacement arising from muscular contraction. This resource certainly proved effectual in one case under my care, where the tibia was broken just above the ankle-joint, attended with marked retraction of the foot, and threatened protrusion of the upper end of the fracture. Erichsen divided the tendon, apparently with less success, in two cases.

2. FRACTURES OF THE LOWER ENDS OF THE TIBIA AND FIBULA, OR OF EITHER BONE SINGLY.—*Structural Conditions.*—Four forms of fracture are

liable to occur near the ankle-joint :—(1) fracture of the articular end of the tibia, obliquely from without downwards and inwards ; and of the fibula about three inches above the ankle ; (2) fracture of the fibula about

FIG. 142.



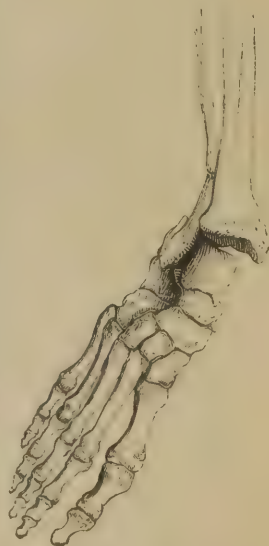
three inches above the ankle, with the tip of the internal malleolus of the tibia, this double fracture constituting *Pott's Fracture*, a very common

FIG. 143.



form (Fig. 143) ; (3) fracture of the fibula two to three inches above the external malleolus, with rupture of the internal lateral or deltoid ligament (Fig. 144) ; (4) fracture of the internal malleolus of the tibia.

FIG. 144.



Displacement in these Fractures varies ; in fracture of the Tibia and Fibula, the upper fragment of the Tibia usually projects *inwards*, and both fragments of the Fibula also in that direction ; in fractures of the Fibula and Tibia, or of the Fibula alone, the same displacement of its fragments occurs—*i.e.*, inwards towards the tibia ; in fracture of the internal malleolus of the Tibia, displacement of this fragment is still inwards.

Dislocation occurs, not unfrequently, in connexion with each of these Fractures, and with that in particular of the inner malleolus *alone* ; which, I believe, seldom happens without, and from, dislocation of the tibia outwards. Respecting fractures of the *fibula*—Hamilton writes : “In *all* the fractures which have been produced by falls on the bottom of the foot, and in all except

one produced by a slip of the foot, the accident was accompanied with a dislocation of the ankle; the foot being turned outwards." The exceptional case was doubtful.

*Signs.*—Deformity is presented, corresponding to the displacement of one or both fragments, with, perhaps, dislocation; and mobility with crepitus, discovered on handling the part.

Fracture of the articular end of the tibia obliquely, and of the fibula, produces a notably increased breadth of the ankle-joint, between the malleoli, with some eversion of the foot, and obliquity of its axis, the toes being turned outwards and the heel inwards.

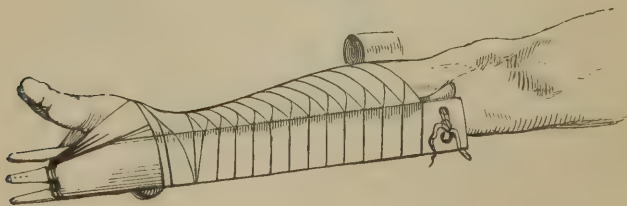
Fracture of the lower end of the fibula, and of the internal malleolus, or Pott's fracture, is accompanied with a very notable eversion of the foot; the sole being turned somewhat upwards as well as outwards, so that the outer edge is directed upwards, and the inner side downwards, on which the patient rests. Thus, Sir A. Cooper, describing his own case, observes: "I broke my right fibula by falling on my right side, whilst my right foot was confined between two pieces of ice; and I could with difficulty support myself to a neighbouring house by bearing on the inner side of the foot."

*Causes.*—*Indirect* violence is certainly the more common cause of these Fractures; either by a fall or jump from a height, breaking the tibia, and fibula secondarily; or by violent eversion or inversion of the foot, breaking the fibula, with the internal malleolus or rupturing the deltoid ligament; or snapping off the inner malleolus alone. The relative frequency of the two latter modes of indirect force has been doubted; most surgical authorities regarding violent eversion as the more frequent; but Dupuytren found inversion to be the ordinary occasion of fracture. Thus, in 200 cases of broken fibula, 120 were produced by inversion or twisting the foot inwards, and 60 only by eversion or rolling of the foot outwards; the remaining 20 arising from *direct* violence applied to the bone itself.

*Union of fracture*—not involving the ankle-joint—takes place readily; and without any appreciable displacement, under proper management and supervision.

*Treatment.*—In all these Fractures, McIntyre's double-inclined plane splint, or Liston's modification of that apparatus, will be found a most efficient means of retaining the fragments in position; and the more so

FIG. 145.



proportionately to their mobility. The trough in which the leg rests, steadies the upper fragments; the foot-piece counteracts any tendency to twisting of the foot inwards or outwards; and the sock supports the heel.

Any marked tendency to eversion of the foot, as in Pott's fracture,



may be more effectually restrained by Dupuytren's splint; a short, straight splint applied to the inner side of the leg, from the knee to the foot. (Fig. 145) The pad should be doubled just opposite the inner malleolus, and a roller wound round the foot and splint in a figure-of-8 form; thereby drawing the foot inwards over the thick pad as a fulcrum, and the roller is then continued upwards to the knee to steady the splint.

*Compound Fractures of the Leg, and of the Ankle-joint.*—In the former situation, compound fracture of the Tibia and Fibula, or of the Tibia alone, happens more frequently than similar injury of any other bone. (Fig. 146.) It was, therefore, selected as the typical form of such Injuries in describing COMPOUND FRACTURE generally. (Chapter xxix.) Its Pathology and Treatment are there considered.

FIG. 146.



FIG. 147.



In relation to the *ankle-joint*, compound fracture (Fig. 147) presents no differences of practical importance. The same considerations guide as to the preservation of the limb, excision, and amputation.

**FRACTURES OF THE TARSAL, METATARSAL BONES, AND TOES.**—These bones are liable to both Simple and Compound Fractures, and with the usual signs of such injuries.

*Fracture of the os calcis* presents particulars worthy of notice. The bone is broken transversely, or comminuted occasionally; and the line of fracture may be either *behind* the lateral ligaments, or through the *body* of the bone. In the former situation, there will be some displacement, the posterior fragment being drawn upwards by the muscles of the calf; in the latter situation, this fragment is retained in position by the lateral ligaments and the strong interosseous ligament.

The *Signs* of this fracture vary accordingly. Marked flattening of the heel on its plantar aspect, or even a depression upwards, and projection of the fragment posteriorly, with mobility and crepitus; denote fracture

behind the lateral ligaments. Comparative absence of these signs, and particularly of the deformity of the heel, denotes fracture more anteriorly, or that across the body of the bone.

*Causes.*—*Direct* violence is, probably, the only cause of Fractures of the Bones of the Foot; excepting, very rarely, in fracture of the os calcis. This bone may be broken transversely, by the powerful action of the muscles of the calf.

*Treatment* consists, as usual, in the adjustment of the fragments, with relaxation of any opposing muscular action; and their retention in position. A gutta-percha or pasteboard splint must be contrived according to the fracture.

In fracture of the os calcis, the tendency to displacement and the more severe contusion may require the support of a McIntyre's splint.

*Compound* fracture generally allows only of excision or amputation. But—as in regard to the hand—the removal of any portion of the foot should be guided by great circumspection and judgment; having due regard to the injured part, and the preservation of this valuable member.

## CHAPTER XXXI.

### DISEASES OF BONE.

#### INFLAMMATION OF BONE.

BONE, or the *Ossæous tissue*, with its investing *Periosteum*, and the *Endosteum* or *Medullary Membrane* of long bones; are, severally, subject to Inflammation. But the pathology of Inflammation as affecting each of these structures is intimately associated, and they are commonly affected simultaneously or consequently. It will, therefore, be more natural to describe in consecutive order; first, the structural alterations pertaining to Ostitis, Periostitis, and Endostitis, and then their diagnostic characters, causes, consequences, and treatment.

(1) OSTITIS OR INFLAMMATION OF BONE.—The cellulo-fibrous network—the organic basis of the lamellæ in the compact and cancellated structure of Bone, with the vascular network ramifying in the Haversian canals and cancelli, is alone the *seat* of inflammation; the inorganic matter, superadded to the fibrous network in the process of ossification, not being subject to any perversion of nutrition or other vital change.

The blood-vessels become enlarged—as shown by Von Bibra and Barwell—giving an injected red appearance to the portion of bone undergoing inflammation; and the fibrous matrix, probably, passes into a state of fatty transformation, as in inflammation of most other textures. The inorganic or earthy matter undergoes merely a disintegrative separation from the fibrous matrix with which it was intimately connected, but retains its chemical composition; and is then absorbed. Such are the earliest structural, and chemical alterations in the inflammation of bone. A change of consistence—softening—accompanies this fatty liquefaction of the organic matrix and unloosening of the inorganic matter. But the Haversian canals, lacunæ, and canaliculi soon become the seat of disintegration and absorption, whereby these natural cavities are rendered

more conspicuous under the microscope; or, opening into neighbouring cavities, irregular spaces are formed. The compact structure thus acquires a rarefied or porous character, presenting the appearance of cancelli; while the cancellated portion is exaggerated. Within these spaces the fatty matter and earthy salts—detritus of the osseous tissue—accumulate; and the products also of inflammation are deposited. They consist of plastic lymph and exudation matter, or pus; the one kind of deposit resulting in induration and hypertrophy of the bone, the other in increased softening and disorganization.

The description of *these* changes belongs to the consequences of Ostitis.

*Serofulous* ostitis, structurally resembles simple inflammation of bone; the osseous substance undergoing disintegration and absorption. Thence the bone is light, soft, and oily. But the rarefied cancelli or spaces in the compact texture, are filled with peculiar products; a red jelly-like matter, or occasionally, a deposit of tubercle. The former is always diffused. The concomitant chemical changes—according to Dr. Black's analyses—consist in a considerable increase of fat in the diseased bone, a large diminution of the salts of lime, a diminution of the organic matrix, and an increase of the soluble salts. Associated with these destructive alterations, minute projections of bone from the walls of the cancelli, evince an attempt at osseous reproduction, thus corresponding to the induration or sclerosis which results from simple inflammation of bone.

*Tubercle* in bone may be either diffused or circumscribed; the latter form being comparatively rare. *Diffused* tubercle occurs commonly in the shaft of long bones. It occupies the cancelli, and appears as a nodulated, or granular, yellowish mass of soft consistence; extending frequently along the whole length of the shaft. *Circumscribed* tubercle is deposited most frequently on the outside of the skull, beneath the periosteum, constituting the *strumous* node; and scarcely less frequently, in the cancelli of the articular end of a long bone, usually the tibia. Tubercle in bone sometimes becomes actually *encysted*; as well as in the lungs, in which organs I have seen cretaceous tubercle enclosed in a distinct cyst.

Tubercular deposit, in either form, is prone to undergo *softening*; the diffused, it is said, passing into this state, less frequently and rapidly than the circumscribed. This change is always one of serious consequence. The softening of tubercular deposit, induces, or is attended with, inflammation of the surrounding bone, and suppuration. An *abscess* thence results, and the bone around becomes condensed and indurated. Or, Caries and Necrosis ensue, destroying the osseous texture. Thus, softened tubercle, a curdy unhealthy pus, and carious or necrosed portions of bone, are commonly found associated and intermixed. The matter extending, may sometimes find its way to the surface; and a chronic abscess, communicating with the bone, remain, discharging, or with little disposition to heal. Or, the matter may find its way to a neighbouring joint, destroying the articulation. But, the comparatively limited localization of tubercle, diminishes the perilous results of these destructive changes. If the shaft of a long bone be affected, the articular ends are, generally, free; and if either end of the bone be the seat of tuberculous deposit, the shaft escapes.

*Syphilitic ostitis* does not seem to be distinguished from simple inflammation of bone by any structural differences of practical importance.

(2) PERIOSTITIS.—Inflammation of the periosteum is usually connected with that of the bone itself—ostitis. The periosteal membrane becomes



more vascular, thickened, softened, and loosened from its connexion with the subjacent bone. These alterations may be seen, sometimes, in the bone of a stump, after amputation. Subsequently, an osseous deposit may take place between the periosteum and bone, with some enlargement and induration of that portion of bone, constituting a *node*.

A *syphilitic* node, which may be regarded as the type, arises from an effusion of lymph between the periosteum and bone; and proceeding from the former, at length involves the bone.

A *strumous* node, on the other hand, consists of scrofulous matter between the periosteum and bone, in consequence of a carious state of that portion of bone.

Suppuration will be noticed as a consequence of Periostitis.

(3) **ENDOSTITIS.**—Inflammation of the endosteum, or membrane lining the medullary canal, and cancelli, is, probably, of less frequent occurrence. This membrane, however, undergoes analogous changes to those of the periosteum, when inflamed—increased vascularity, and thickening. A deposit of lymph or pus ensues, in consequence of endostitis.

**SIGNS.**—*Ostitis*, affecting the deeper portion of the substance of a bone, is unattended with any appreciable signs, in the first instance. A deep-seated wearing pain, generally precedes any alteration of external appearance. This pain is more severe at night, and aggravated by changes of weather; thus resembling rheumatic pain, for which it may be mistaken. Enlargement of the bone at length becomes perceptible; with, perhaps, some redness, œdematous swelling, and tenderness of the integument. This swollen state of the integument renders any enlargement of the bone more apparent than real. Softening of the bone, in some portion of its substance, may eventually be detected on pressure; but the diagnosis will be sufficiently obvious, without subjecting the patient to the pain of such examination.

*Scrofulous* ostitis is attended with more considerable enlargement of the bone, and of an indolent character. The surrounding integuments are œdematous, white, and painless; becoming somewhat red and tender, as suppuration supervenes. The concomitant symptoms of scrofula will also determine the diagnosis.

*Syphilitic* ostitis must be diagnosed entirely by the concurrence of present and past symptoms of Syphilis.

*Periostitis.*—The symptoms are similar to those of ostitis, but more simultaneous, and superficial. A painful, puffy swelling, is presented; the pain subject to exacerbations, and the swelling acquiring a bony hardness. These diagnostic characters are well illustrated by an ordinary syphilitic *node* in a subcutaneous bone, as the shin.

*Endostitis* is not characterized by any peculiar symptoms, apart from those of *Ostitis*.

**CAUSES.**—Inflammation of bone usually results from *external* violence or from exposure to cold; but it arises under the influence of some predisposing *constitutional* condition of disease. These predisposing causes comprise secondary or constitutional syphilis, or the excessive influence of mercury—of rare occurrence now-a-days; the scrofulous taint; rheumatism; and probably other conditions affecting nutrition. Either class of causes—the traumatic or the constitutional—may be *alone* sufficient to induce osseous inflammation. The bones most liable to inflammation are, however, those most exposed to the action of external agents. Hence, the tibia, cranium, and especially the frontal bone, the

clavicle, sternum, ribs, and bones of the foot and hand, are most commonly affected.

CONSEQUENCES.—The consequences of inflammation of bone have been incidentally noticed in describing its structural conditions; and particularly in connexion with serofulous ostitis. They may now be more definitely stated as follow:—(1) *Absorption* and *rarefaction* of the bone having taken place; the osseous texture may be found in this state, before the supervention of much deposit. (2) *Induration* or *sclerosis*, having taken place; an increasing deposition of plastic lymph and its ossification, results in considerable thickening of the substance of the bone, and irregular osseous deposit on its free surfaces. Thus, a long bone becomes thickened in the diameter or substance of its shaft; and deposition proceeding within the medullary canal, its bore is narrowed; while periosteal deposit, at the same time, enlarges the circumference of the bone. Elongation of a long bone is, sometimes, consequent on its inflammation. The tibia has thus become longer than its fellow by nearly two inches. The osseous substance, resulting from inflammatory induration, is more solid, heavier, and harder than that of healthy bone, increasing even to the consistence of ivory; and the nutritious foramina are said to be increased in size. This state of hypertrophy corresponds to the inflammatory solidification of parenchymatous organs. But, as regards bone, it is a termination by restoration to health, or something beyond the natural condition of healthy bone. (3) *Suppuration* of Bone—another consequence of inflammation, of an opposite character to induration—merits a separate notice; also *Caries* or ulceration of bone; and *Necrosis*, which is analogous to sloughing or mortification of the soft textures.

TREATMENT.—In *traumatic* and *acute* inflammation of bone—whether in the form of Ostitis or Periostitis—the ordinary remedial measures for Inflammation will, usually, suffice. Warm fomentations, leeches, and rest, with the administration of calomel and opium, are appropriate. In *constitutional* and *chronic* inflammation, this treatment must be supplemented, or partly superseded, by the general treatment for secondary syphilitic affections, scrofula, or rheumatism. Iodide of potassium is thus often singularly efficacious, in syphilitic or rheumatic ostitis or periostitis.

Tension and insupportable pain are more readily and permanently relieved by free incisions, than by any medicinal treatment. In periosteal tension, these incisions should be made down to the bone; in tension resulting from ostitis, an incision may be prolonged, by means of a Hey's saw, through the bone, down to the medullary canal, as Mr. Erichsen recommends. Trephining the bone has been resorted to for the relief of osseous tension. Chronic thickening, unattended with much pain, may be removed or lessened by the application of blisters, iodine and mercurial ointments.

SUPPURATION OF BONE.—Suppuration, in connexion with bone, is liable to occur in either of the three situations described with reference to inflammation; and it may be either diffused or circumscribed; these conditions being also, less definitely, acute or chronic suppuration, respectively. Thus we recognise;—(1) *Osteo-myelitis*, *diffuse* suppuration of bone, within the *medullary canal* and cancelli; (2) *Diffuse Periostitis*, and *Periosteal Abscess*; and (3) circumscribed *abscess* of Bone, within either the cancellated or compact structure.

(1) *Osteo-myelitis*.—This condition certainly occurs, and not unfrequently; but—as Mr. Holmes observes—it is less frequently recognised

at the bedside than in post-mortem examinations. The results are diffuse suppuration, the cancelli being found loaded with pus, while the medullary membrane is usually injected and often sprinkled with ecchymoses; the periosteum is often partly separated from the bone, but the osseous texture has not generally undergone any appreciable change. At this stage, in the larger bones, the disease usually terminates fatally. Otherwise, the pus may penetrate into adjoining parts, probably into the nearest joint; or central necrosis may ensue.

The *Signs*—during life—are neither absolute nor obvious. Separation of the periosteum, with diffused pain in the bone, and diffuse inflammation of the integuments, are equally the symptoms of osteo-mylitis and of diffuse periostitis. An absence of effusion between the periosteum and bone is distinctive of osteo-mylitis; but this condition can scarcely be determined by external examination of the bone, and is often rendered more obscure by the superimposed œdematous swelling.

The *cause* is usually some injury implicating the medullary membrane and cancellated structure of the bone affected. Thus, osteo-mylitis, not unfrequently follows amputations, and other operations exposing the medullary canal.

It runs a rapid course, is commonly succeeded by pyæmic infection, and thence terminates fatally.

*Treatment.*—*Preventive* measures afford the only reasonable chance of anticipating this issue; the cure of pyæmia being beyond the reach of any known remedial agents. The ambiguous symptoms of diffused pain in a bone, with perhaps, some œdematous swelling, will, therefore, warrant the Surgeon in ascertaining the state of the periosteum, to determine the diagnosis. Under these circumstances, an early, free incision should be made down to the bone.

If the periosteum is discovered to be separating, without any notable effusion between it and the bone, it will be justifiable to *trepphine* the bone, with the view of giving exit to any matter which may have formed in the deeper cancellated structure. *Excision* of the affected portion of bone, or *amputation* of the limb, must be had recourse to, as more extreme measures.

(2) *Diffuse Periostitis.*—This diseased condition is of rather frequent occurrence; but it has hitherto been less noticed in surgical works than its importance demands. Diffuse Periostitis—according to Mr. Holmes' observations—appears to consist in the partial separation of the periosteum from the bone; by effusion of lymph or other products, on the surface of the latter. Copious suppuration soon spreads along the bone, detaching the periosteum, often from one end of the bone to the other. At an early period, neither the periosteum nor the surface of the bone is visibly inflamed. The latter, indeed, may look white and bloodless, or sometimes, slightly worm-eaten; it yields, on pressure, large drops of blood from the periosteal vessels passing into it, and its superficial layers are more readily separable from the deeper osseous texture, than in health. Necrosis is soon established, the whole diaphysis of the bone usually, perishing; leaving the articular ends unaffected, and therefore not involving the neighbouring joint. Sometimes, it does not escape. The long bones are more often affected than the flat or irregular bones; and, in the great majority of cases, the *femur*.

*Signs.*—Arising insidiously, an œdematous, painful swelling is presented—diffuse cellular inflammation—resembling acute rheu-



matism. But, suppuration soon following, the diagnosis is at once determined.

The *causes*, would seem to be some injury to the bone, occurring, however, in a scrofulous or weakly person. The disease is said to be met with more commonly about the age of puberty, and in boys more than in girls.

It rapidly runs its course; pyæmia frequently supervenes and proves fatal; or the matter burrowing among the muscles, forms numerous fistulous openings, exposing necrosed bone. The dead portion is detached much sooner, apparently, than in ordinary necrosis; and reparation also seems to be equally active.

*Treatment*.—Early and free incisions are here, also, primarily important. During the process of cicatrization, injections of very dilute hydrochloric acid may be used, as highly recommended by Chassaignac, to cleanse the suppurating cavity and hasten exfoliation of the dead bone. A generally stimulating plan of treatment will be required to support life through this trying ordeal.

*Chronic periosteal abscess remaining*, requires no special treatment.

(3) *Circumscribed Abscess of Bone*.—Always a chronic condition; this state of suppuration differs also from diffused suppuration, in its limited extent, and in being distinctly circumscribed. The abscess, thus defined, is seated within the substance of a bone, usually its cancellated structure; the cavity is lined by a distinct pyogenic membrane, and the surrounding bone is more vascular than natural, and much indurated. The size of this cavity is never large, probably not exceeding that of a small chestnut, and containing two or three drachms of pus, greenish-yellow or dark coloured. Always situated in one of the long bones, the abscess is commonly located in its upper or lower articular extremity, and very rarely within the medullary canal of the shaft. The *tibia* is most frequently affected, and its upper end near the knee-joint; its lower end near the inner malleolus, next in order of frequency; and among other bones, the lower end of the humerus near the elbow, and the femur, have severally been found the seat of circumscribed abscess. Sir B. Brodie first discovered and described this abscess, and pointed out its appropriate treatment; since the time of his observations, it has occasionally been met with by other surgeons; and recently, Mr. T. Carr Jackson contributed an instructive Paper with three cases bearing on the subject.

*Symptoms*.—Pain is at once the earliest, and most significant symptom. It is of a heavy, aching, and eventually, throbbing character; more severe occasionally, or perhaps periodically—generally during the night, and persistent for a considerable period—being probably of some years' duration. This pain is referred to a particular part of the bone at one extremity—in for example, the head of the tibia; and a point of greatest intensity can be discovered by careful palpation with the finger, where the slightest pressure produces excruciating agony. A small and slight puffy swelling, or induration, surrounds this spot; and the skin may be adherent to the periosteum, without presenting any discoloration. Beyond this external appearance, little or no enlargement of the bone accompanies the remarkable pain of which the patient complains; and there is an absence of any symptoms of joint-disease.

*Diagnosis*.—The nature of this disease may, however, be mistaken for chronic rheumatism, or periostitis; or still more probably, for a neuralgic or hysterical affection. The *persistence* of the pain is the most distinctive character of circumscribed abscess of bone.

*Causes.*—This abscess can, sometimes, apparently be referred to injury, or exposure to cold. The influence of tubercular disease, is very uncertain. Early adult life seems to be the period most liable; but the ages in recorded cases have varied from 13 to 50. Males and females have been affected indiscriminately.

*Course and Terminations.*—The abscess slowly enlarging, by the excavation and condensation of the surrounding bone, never attains a large size. Ultimately, it opens into the neighbouring joint, which thus becomes disorganized; and a disposition to this result is evinced by synovial distension and swelling from time to time, after exercise. Or the abscess *may* open externally, and discharge its contents with complete relief to the previous suffering. Cicatrization follows, the cavity filling up as in the termination of other abscesses; and the fibrous material which occupies the space, probably undergoing ossification, obliterates any remnant of the abscess.

*Treatment.*—No topical applications or medicinal treatment have the slightest curative efficacy. But the operative proceeding proposed by Sir B. Brodie is at once simple and safe, affords immediate relief and a permanent cure. It consists in trephining the bone over the seat of abscess, and in thus giving vent to the pus. Chloroform having been administered, a crucial incision is made immediately over the painful spot externally, and extending down to the bone. A small trephine, having no projecting rim to oppose its entry, is then applied, and worked through the indurated bone; penetrating to some depth, and entering the cavity of the abscess. The circle of bone is detached and removed by an elevator or gouge, and the pus evacuated. Or, a drop may appear, and the bone must be penetrated further by the gouge until the cavity is entered. Sometimes no pus is discovered on raising the circle of bone; the exposed surface should then be pierced in various directions to find a drop, and the oozing aperture freely enlarged with the gouge. Otherwise, an abscess may exist, but remain undiscovered. This misadventure happened to an experienced Hospital Surgeon; the limb was amputated, and an abscess found at a small distance from the seat of perforation; showing that the removal of a small portion more of the bone would have preserved the limb. The preparation is in the Museum of St. George's Hospital. Only a small quantity of matter will issue in any case, the abscess itself being small. But the cavity having been fairly opened, the relief following the cessation of tension is instantaneous. A poultice or water-dressing will suffice during the course of reparation; which proceeding uninterruptedly, a permanent cure is established.

An error of diagnosis even may be unimportant as regards the favourable result of this simple operation. For if the disease prove to be chronic osteitis—as happened in the case of one of Sir B. Brodie's patients—the removal of a piece of bone will relieve the pain, and may induce a healthier action.

*CARIES OR ULCERATION OF BONE.*—The term Caries has been applied to different morbid conditions of Bone. By some Surgeons it has been used to denote scrofulous ulceration, exclusively; and by others, to represent a morbid condition peculiar to bone, as distinguished from that of ulceration affecting the osseous texture. But the pathological identity of Caries and Ulceration is now generally acknowledged; and as such I use the term to signify Ulceration, modified only by the textural peculiarities, of Bone.

*Structural Conditions.*—Caries is essentially a disintegration of the osseous texture; and like ulceration of the soft textures, it may be presented in two forms—as enlarging a pus-discharging cavity or abscess in the *substance* of Bone, and as affecting the *surface* of a Bone.

Carius bone is softened, and easily breaks down under pressure with a gritty resistance; it is porous, and infiltrated with a reddish-brown oily fluid, and granular inorganic matter—the *débris* of the disintegrated texture. Small detached masses of dead bone may be found associated with the carious bone. It has a greyish, brown, or black colour, but the surrounding bone is highly vascular. Beyond and around the carious area, induration and hypertrophy may have taken place; the circumferential substance of the bone being dense, and presenting externally osseous nodules or spicula, with thickening of the periosteum.

In the *substance* of bone, the appearance of Caries is more marked in the cancellated structure, which is also more especially the seat of caries. The enlarged cancelli are filled with the detritus, and their walls are in a softened state; the whole crumbles down under pressure with the finger, or may be readily penetrated by a probe, and yields with a grating sensation. This condition is commonly found in the articular extremity of a long bone; as that of the *tibia* or *jémur*, in *scrofulous* disease of the knee-joint affecting either bone.

On the *surface* of a bone, Caries presents a drilled, worm-eaten appearance (Fig. 148). The periosteum is loosened or detached, thickened, vascular and villous. The projections, thus formed, pass from the under surface of the periosteum in corresponding depressions in the bone, its compact structure having acquired more the open character of the cancellous. The textural condition of the bone is similar to that already described as pertaining to deep caries. Superficial caries is, perhaps, more commonly seen in the *cranial* bones, and as resulting from secondary *syphilis*. A somewhat significant resemblance exists between the forms of syphilitic ulceration in bone and syphilitic eruption on the skin. Thus, Mr. Paget has described, *annular* or circular, *reticulated*, and *tuberculated*, ulcers of bone. But these various forms are more interesting pathologically, than diagnostic.

The *Signs* of Caries, are the characters of carious bone, as just described. They are not declared until abscess having formed and discharged, the bone becomes exposed, or accessible. Superficial caries is more open to examination; but the introduction of a probe will readily discover the state of the bone, both in it and deep caries. Both forms of Caries, deep and superficial, are attended with pain, more or less deep-seated, redness and swelling of the integument; followed by suppuration and the formation of abscesses. The soft parts around then present the usual characters of increased swelling, fluctuation, and discoloration. Any such abscess bursting, discloses the carious state of the subjacent bone, or leads to a carious cavity, as discovered by a probe. Fistulous openings remain, discharging unhealthy pus mixed with the granular detritus of bone. (Fig. 149.) Large, outcropping, abortive granulations spring up; and the surrounding integument has a congested purplish appearance. Caries evinces little disposition to undergo any reparative changes,

FIG. 148.





FIG. 149.



The *Causes* of Caries are those which produce inflammation of bone, especially as occurring under the influence of some *constitutional* condition. Scrofula and syphilis thus not uncommonly affect the bones, and in the form of Caries; the disease arising often, apparently, without any external occasion of injury as an exciting cause.

*Treatment.*—The removal of any cause in operation is the primary rule of treatment in this, as in all other conditions of disease. Hence the remedial measures appropriate for Constitutional Syphilis or Scrofula, will be requisite, in most cases of Caries. Rest of the affected part is highly advantageous; but any topical applications, as counter-irritation, by iodine, blisters, or issues, are useless, compared with constitutional treatment. In an *early stage*, the disease may thus be arrested and the bone restored to a healthy state.

Or, under the influence of this treatment, disintegration proceeds only so far as to gradually remove the affected portion by a gritty discharge; recovery then taking place by granulation.

In a *chronic* state, the disease is beyond the power of restoration, and reparation is unable to discharge the carious portion of bone piecemeal.

*Operative* interference, therefore, now becomes necessary. The diseased bone may be removed by excision, of either the affected portion only, or of the whole bone; or amputation may be unavoidable, owing to the extent of the disease, or after excision, as the last resource.

*Excision* of the carious portion. This should always be a patient proceeding, never a “brilliant” operation. The bone having been exposed by a crucial incision, the diseased portion must be removed piecemeal by means of a gouge. Various forms of this instrument are used, according to circumstances. The ordinary scoop-gouge (Fig. 150) is generally most convenient; and the rose-head osteotrite will often prove very serviceable in finishing off a carious cavity. Care should be taken in working with a cutting-gouge, lest the instrument suddenly slip, and be driven accidentally into the soft parts. A steady, slow movement of the hand, and grasp of the instrument almost to the point, are the best precautions against any such misadventure. The carious portion of bone yields to the gouge with a gritty resistance; whereas the sound bone remains firm, and vascular. The *extent* of bone to be removed may, therefore, be determined by these characters; portions of softened, crumbling bone should be scooped out, until the firm, rose-coloured bleeding bone is reached. The surface or cavity, having this healthy character, is then dressed or plugged lightly with wet lint, and the

FIG. 150.



tions of softened, crumbling bone should be scooped out, until the firm, rose-coloured bleeding bone is reached. The surface or cavity, having this healthy character, is then dressed or plugged lightly with wet lint, and the

wound allowed to fill up and heal by granulation. In this way I have removed, more or less successfully, carious bone from nearly every bone. The whole rim of the spine of the scapula having been excised in one case, the patient—a lady of very delicate health—recovered slowly but soundly. In another case, I removed the whole of the middle third of the shaft of the tibia, excepting a shell of bone posteriorly. Granulations, healthy and abundant, sprang up, and nearly filled up the large cavity; but the patient by the rules of the hospital, as to time, left incompletely cured, and I do not know the result.

The *articular end* of a bone—affected by Caries—may require excision, as will be fully explained in treating of Diseases of the Joints.

Excision of the *whole* bone is rendered necessary by an extent of disease beyond the range of either of the previous partial operations, in the shaft or articular end.

*Amputation* is justifiable only as the last resource. The foot, for example, may be removed for carious disease involving the tarsal bones; or when excision has failed.

**NECROSIS.**—The death of a portion of bone is analogous to Mortification of the soft parts; and it has the same pathological relation to Caries that Mortification has to Ulceration. Caries is molecular death or disintegration of the osseous texture; Necrosis, the death of a visible portion or mass of bone.

*Structural Condition.*—Necrosis—like Caries—may affect the *substance*, or the *surface*, of a bone. In the one form of necrosis, the dead portion is named the *sequestrum*, a term more particularly applicable when the piece of bone is loose and enclosed by new bone; and when limited to the deepest portion of bone around the medullary canal, this is sometimes named *central necrosis*; while, in the other form, a superficial scale-like portion of dead bone is designated an *exfoliation*.

Necrosed or dead bone, is rough, hard and white; becoming brown or black when exposed to the action of decomposing pus and the air, from sloughing of the integument. It is avascular, not yielding any blood when wounded, and insensible.

The *whole substance* of a bone, or its *central* portion only, may be in this state; in point of extent also, the whole length of the shaft of a long bone is sometimes necrosed, and occasionally, even the epiphyses are involved. But, the periosteum, at first adherent, soon loosens its connexion with the subjacent dead bone, and deposits ossific lymph between itself and the surface of the bone. This deposit undergoing ossification, forms a sheath of new bone over or around the dead portion, which thus becomes enclosed in an osseous sheath. The periosteum is the chief, but not the only source of osseous reproduction in necrosis. Respecting this vexed question; observation has shown that the original bone itself is an important source of new bone—by granulation—in the absence of the periosteal membrane, or in central necrosis; and that the medullary membrane may contribute its share. The articular ends, in particular, evince a remarkable ossific power, when the shaft of a long bone is removed. Apart from the osseous texture and medullary membrane; the soft tissues around the bone may also acquire the power of forming ossific deposit. The dead portion, at first continuous with the healthy bone, loses its connexion at the line of continuity; the living bone detaching itself from the dead. Ulceration takes place in the course of that line, and forms a groove around the junction of the dead portion of

bone; this groove deepening, at length completely detaches it. This twofold process goes on simultaneously, though not perhaps equally; constituting a *separation* of the living from the dead bone, and *reparation* chiefly by the periosteal reproduction of a sheath of new bone enclosing the dead portion. Both changes are slowly progressive. But at length, the *sequestrum* becomes complete and ensheathed.

*Exfoliation*, or superficial necrosis, presents the same appearances as to the state of the dead portion of bone. But, it results generally from the destruction of the periosteum; consequently, no periosteal sheath of new bone is produced. The plate of dead bone is detached—as in deep necrosis—by linear ulceration forming a groove circumferentially; but, the detached portion not being ensheathed by new bone, it is thrown off from the surface or exfoliated, and exposed by open abscesses or sloughing; or it can be easily removed surgically by forceps. The periosteum of the *cranial* bones, even when uninjured, does not seem to have the power of forming a sheath of new bone; and thence the same result ensues—exfoliation.

The *Signs* of Necrosis are, the characters of necrosed bone, as already described. But—as with Caries—these characters are not declared until abscess having formed and discharged, the bone becomes exposed or accessible. Exfoliation is more open to examination; and the introduction of a stout probe will readily discover the rough, loose sequestrum; or, when visible, it may be recognised by its dead white appearance.

Necrosis is attended with violent and deep-seated pain, considerable redness and swelling of the surrounding soft parts. Suppuration ensues sooner or later, in consequence of inflammation of the bone—ostitis, having led to and being connected with the necrosis, or as the result of prolonged irritation of the sequestrum—itself a foreign body. Pus collects around the sequestrum, and interrupting the complete formation of the periosteal sheath of new bone, leaves apertures therein, named *cloacæ*; through which, sinuous tracks between the sequestrum and fistulous openings in the integument, become established. Thus is presented the structural condition of necrosis, commonly seen. (See Fig. 149.) Unlike Caries, this condition occurs more frequently in the shafts, than in the articular ends, of long bones; and usually in the compact, rather than the cancellated, structure of any bone.

*Central* necrosis is necessarily more obscure, owing to the depth of the morbid condition. The symptoms resemble those of chronic abscess in the substance of bone. Deep-seated and, perhaps, throbbing pain, with some swelling of the bone, or puffiness over a particular spot; are the more characteristic symptoms, and their persistence is even more significant.

*Causes.*—*External* and *traumatic* causes seem to have a more absolute effect in producing necrosis, unaided by any predisposing constitutional influence, than in relation to caries. Any injury detaching the periosteum, will probably be followed by more or less necrosis; excepting in the cranial bones, or others which are highly vascular. Violent contusion may so damage the osseous texture and medullary membrane, as to produce necrosis. Severe cold, as in frost-bite, and deep burns, are also immediate causes. Powerful irritants have a marked effect, apart from any inflammatory action. Thus, the fumes of phosphorus, in lucifer-match manufactories, often produce necrosis of the lower jaw; this powerful irritant entering the bone, apparently, through carious teeth.



Any condition of inflammation of bone—ostitis, periostitis, or osteomyelitis—may also induce necrosis.

*Constitutional* causes are very influential; sometimes predisposing only, or frequently producing, necrosis. Scrofula, syphilis, and formerly, the excessive administration of mercury, represent this class of causes; but necrosis occasionally, results from typhoid fever and other exhausting diseases.

*Consequences.*—Continued suppuration accompanies necrosis, and in proportion to its extent. The matter burrows among surrounding muscles, and disorganizes the whole substance of the part; while the numerous sinuses opening externally and communicating with the bone, continue to discharge an unhealthy pus. Large, protuberant granulations, springing up around the orifices of these passages, evince an abortive tendency to close up the soft parts; but reparation of the bone, by the formation of a periosteal sheath, is far more active. The ulcerative detachment of the dead portion of bone, sometimes extends to a large vessel, or the point of the sequestrum may be driven into an artery in some movement of the limb; giving rise to serious hæmorrhage externally, or the formation of aneurism. But these perilous consequences are rare. Hæmorrhage from ulceration, occurred in a case of necrosis of the femur which thus involved the popliteal artery, as shown by Dr. Porter in the "Dublin Journal," vol. v.; and in two other cases the artery was wounded by a sequestrum during active movements of the limb: one of which is related by Dr. Byron in the "Med.-Chir. Rev.," vol. xxiv., and the other by Dr. Jacob, in his "Diss. Med.-Chir. de Aneurismo," Edin., 1814. Mr. Stanley mentions a case in which the capsule of the knee-joint was penetrated by the pointed end of the necrosed shaft of the femur. Mr. Holmes has seen fatal hæmorrhage from the lingual artery in disease of the jaw, the nature of which is not stated; and from the aorta in caries of the spine.

*Treatment.*—The removal of any cause in operation, must be the primary consideration. *Traumatic* causes, which have already expended their force, so to speak, in producing necrosis, are obviously not under control. But, as arising from detachment of the periosteum, exfoliation may sometimes be prevented by timely replacement of this vascular membrane; or if adhesion takes place between the bone and adjoining soft parts, or granulations spring up from the surface of the bone, a new periosteum will be gradually formed.

*Constitutional* causes cannot be altogether overcome, but their full effect may be prevented. Hence, the medicinal treatment appropriate for scrofula, or constitutional syphilis, proves very beneficial in most cases.

*Suppuration* and *abscess* must be treated on ordinary principles; while the accompanying hectic and constitutional irritation of dead bone, should be supported by a tonic and stimulant plan of treatment with nourishing diet.

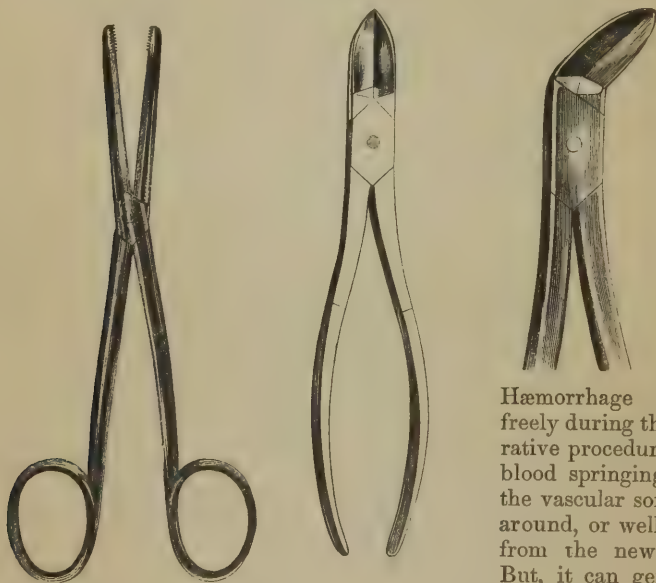
*Extraction of the sequestrum.*—The dead portion of bone is a foreign body. Unless, therefore, it be thrown off by Nature, it must be removed by Art. Its removal is determined, both in point of time and the extent of dead bone to be removed, by the ulcerative line of demarcation and the detachment of that portion; a process of some weeks' or months' duration, and the progress of which should be ascertained, from time to time, by examination with the probe. A loosened sequestrum, imprisoned

within a sheath of new bone, can only be extricated by surgical interference. The operation consists in cutting down upon the bone, and extracting the sequestrum, by means of serrated bone-forceps. (Fig. 151.) In making the incision, advantage is taken of the course of the fistulous tracks leading to the cloacæ in the bony case; and then the latter apertures are made available for removal of the sequestrum. Sometimes, one of the cloacæ is sufficiently large to allow of the extraction of the sequestrum through it. Or the cloacæ may be enlarged, or two apertures thrown into one by excising the intervening portion of the bony case, with strong-cutting pliers, straight, or angular bladed. (Figs. 152, 153.) Or again, it may be more convenient to divide the sequestrum by the same instrument, and extract either fragment separately. The removal of any portion of the bony case, is undesirable, as the new bone is not reproduced, and the limb, therefore, remains proportionately weakened.

FIG. 151.

FIG. 152.

FIG. 153.



Hæmorrhage occurs freely during this operative procedure; the blood springing from the vascular soft parts around, or welling up from the new bone. But, it can generally be arrested by pressure.

The bottom of the wound should be lightly dressed with lint; any inflammation consequent on the operation must be subdued by ordinary treatment; and eventually the limb should be supported by a starched bandage until granulation is complete and the bony case has acquired sufficient strength, to bear the weight of the body or the movements of the part. I have thus, from time to time, removed several loose sequestra from the lower half of the shaft of a femur; guided by the sinuses, and preserving the osseous case which had formed around the bone. In a compound fracture of the tibia with detachment of the periosteum; the end of the upper fragment to an inch and a half in extent, separated as a sequestrum, which I removed, together with several small scaly and spiculous portions from the lower fragment. Union ensued, but imperfect consolidation; a slight hinge-like mobility remaining for some months. An *exfoliation* may be

thrown off naturally; but this process will be much facilitated surgically by incisions, when the dead portion has separated.

*Excision of the whole of the bone necrosed, or short of its articular end.*—This operation may, occasionally, be had recourse to in *extensive* necrosis. Thus, the lower jaw has not unfrequently been removed for necrosis caused by the fumes of phosphorus. The entire shaft of the radius, leaving its articular ends, was excised by Mr. Savory, on account of necrosis; and afterwards, the bone was reproduced from either end to such an extent, that in eight months there remained an interval of only

FIG. 154.



an inch and a half, and this appeared to be gradually diminishing. The fibula also has been excised. Removal of the ungual phalanx of a finger, for necrosis from whitlo, has proved perfectly successful in preserving the end of the finger. These results are sufficient, to encourage the practice of excision in other cases of extensive necrosis. In operations for bone-excision, in necrosis, as of the lower-jaw; a short, narrow-bladed saw will often be found very convenient. (Fig. 154.)

*Amputation* must be regarded as an extreme resource, but justifiable as a sacrifice of the limb for the preservation of life. In necrosis involving the neighbouring joints; or where the limb has become disorganized by prolonged and profuse suppuration; or the general health undermined by hectic; amputation is unavoidable. Thus, in a case of necrosis of the femur consequent on typhoid fever in India, the whole shaft of the bone was involved, the limb enormously thickened, and the muscles were matted together. I amputated the limb close to the trochanter, and the patient made an excellent recovery, regaining his general health. And in the more rare cases, also, where a main artery is opened by ulceration, or wounded by the sequestrum; amputation will generally be preferable to ligature of the vessel, *in situ*, or of the main trunk.

**RACHITIS OR RICKETS.** — *Structural condition.* — This disease affects more or less the whole osseous system. The earthy matter of the bones is diminished, and the organic basis, therefore, proportionately increased; the cancelli are enlarged and filled with a brownish-red fluid. Bones in this state have acquired great softness and flexibility, thence undergoing remarkable changes of shape, in consequence of the weight of the body, or other forces to which they are subject. The bones of the limbs in particular become curved and distorted, the pelvis collapsed and twisted, the thorax contracted above and enlarged lower down by the dragging weight of the abdominal viscera, and the spine often undergoes lateral curvature. The cranium appears enlarged, owing perhaps to the imperfect development of the facial bones; presenting a large head and diminutive face.

The *Signs* of rickets are some of these peculiar deformities of the osseous system. They occur also in connexion with manifestations of scrofula.

The *Causes* of this disease are obscure. It would appear to be a condition of imperfect formation of the osseous texture; rickets never



arising after the bones have become fully ossified and consolidated; nor, indeed, after the age of puberty. It is a disease of childhood or infancy, and possibly commencing in foetal life; although its results remain in the adult.

*Termination.*—The bones become strengthened by osseous deposit in the parts most requiring support; the long bones acquiring increased thickness in their small curvatures, and the deposition extending even into the interior, so as to partially obliterate the medullary canal.

*Treatment.*—The primary indication obviously is, to supply the deficient earthy matter; and so, probably, arrest the disease. But no known medicinal preparation seems to have this effect. The phosphates of lime, or lime-water, have been administered; but in several instances I tried them without any perceptible result. Iron and quinine combined, often prove more beneficial. These medicinal tonics, with due regulation of the bowels, nutritious diet, pure air, sea-bathing, frictions, and other means for improving the general health; constitute the most effectual plan of treatment. Daily exercise may be taken advantageously; but the bones of the lower limbs should be relieved from the weight of the body, by the patient reclining at intervals during the day, and wearing steel-supports so applied as to resist any tendency to curvature. Many a little, scrofulous child—pot-bellied and bandy-legged, may thus be reared to man's estate; when Nature will complete the cure.

**MOLLITIES OSSIIUM—OSTEOMALACIA—MALACOSTEON.**—*Structural condition.*—This diseased state of the bones is far more rare than rickets, only a few instances having been recorded; but it is also far more serious. The earthy matter is greatly diminished, but replaced by a peculiar reddish gelatinous matter, chiefly fatty, and containing nucleolated nuclear cells, which have been described by Mr. Dalrymple.

This matter occupies the cancelli, which are considerably enlarged, and cavities in the compact texture; infiltrating the whole substance of the bone, until, as Dr. Ormerod remarks, it more resembles fatty matter enclosed in a periosteum than a bone. Bones thus affected, are soft and flexible; on section, the osseous texture yields a gritty sensation, and has a reddish-brown or maroon colour, exhibiting the peculiar gelatinous matter in an extremely rarefied osseous texture. The chemical composition of bone in this state—according to Dr. Leeson's analysis—is; in 100 parts—18·75 animal matter, 29·17 phosphate and carbonate of lime, and 52·08 water.

Commencing, apparently, in the cancellous tissue, the compact portion may retain its natural consistence, as an outer shell of bone; and the whole length of a long bone may not be affected. But many bones are always simultaneously diseased. Fracture, or bending without fracture, ensues, according to the extent of the disease. When softening is limited to the *internal* part of the bones affected, leaving an outer shell of hard bone, fracture is liable to occur; in one case, related by Tyrrell, 22 fractures happened; in another, by Arnott, 31 fractures. When the disease involves the *whole thickness* of the bones, they become bent in various forms, and to an extreme degree; presenting the most remarkable and frightful deformities. For example, the thighs have been bent, until the feet touched the head.

Mollities ossium and Rickets have some structural characters in common; the marked diminution of earthy matter, and rarefaction of the osseous texture; both diseases also affect more or less the osseous

system generally. But the gelatinous matter is peculiar to mollities ossium. In respect of its fatty character, the disease has some affinity to fatty degeneration; while, in virtue of the nuclear and nucleated cells, a few of which may be caudate-shaped, there would appear to be some alliance to the structural elements of Cancer.

*Signs and Symptoms.*—Certain premonitory symptoms, usually, precede fracture or deformity from mollities ossium. Wandering pains in the affected bones are experienced, and of a rheumatic character, but more severe and persistent. Marked failure of the general health accompanies these osseous pains; while great exhaustion and some emaciation precede any perceptible change in the bones. Then a fracture here or there, and progressive deformity, leave scarcely any doubt as to the nature of the disease.

*Diagnosis.*—From *Rheumatism*, it is at once diagnosed by these manifestations of morbid osseous condition; from *Cancer*, by the very general distribution of the disease, affecting more or less the whole osseous system, and by the deformity. Thus, according to Litzmann, in 85 child-bearing women, the whole skeleton was affected in 6 cases, and all the bones except those of the head in 2; and in 46 other cases, all parts of the skeleton were diseased in 21, and all the bones except those of the head in 6. From *Rickets*, as well as other diseases, Mollities Ossium may be distinguished by another symptom. The state of the *urine* is peculiar. It contains a great abundance of earthy matter, which was shown by Mr. Solly to be phosphate of lime, removed from the bones and eliminated through the kidneys. But the urine may also contain a peculiar substance, nearly allied to albumen, and in great abundance. According to the analysis of Dr. Bence Jones, in Mr. Dalrymple's case, this substance is the hydrated deutoxide of albumen, and that 66·97 parts were passing out of the body in every 1000 parts of urine. Here, therefore, there was as much of this albuminous substance in the urine, as there is of ordinary albumen in healthy blood; an ounce of urine passed was equivalent to an ounce of blood lost, as regards its albumen. "The peculiar characteristic of this hydrated deutoxide of albumen was its solubility in boiling water, and the precipitate with nitric acid being dissolved by heat and reformed when cold. By this reaction a similar substance in small quantity may be detected in pus, and in the secretion from the vesiculæ seminales. The reddening of the urine on the addition of nitric acid might perhaps lead to the re-discovery of this substance; when found, the presence of chlorine in the urine, of which there was a suspicion in the above case, should be a special subject of investigation, as it may lead not only to the explanation of the formation of the albuminous substance, but to the comprehension of the nature of the disease which affects the bones."

*Causes.*—The pathological cause of mollities ossium is unknown. But the disease in no way arises from an imperfect formation of the osseous texture, and does not generally occur before the middle period of life, or subsequently; thus, also, differing from rickets. It would appear to be hereditary, in some cases. Females are more subject than males, and repeated pregnancy seems to engender a predisposing condition.

*Termination.*—The fractured bones evince little or no tendency to the formation of callus; and as the deformity resulting from their bending increases, the patient becomes a wretched cripple, yet living perhaps for years. Ultimately, death ensues from sheer exhaustion; or, func-

tional disturbance, consequent on altered relations of the viscera or pressure from deformity, proves fatal.

*Treatment.*—No known medicinal agents have any curative efficacy. A generally tonic and nourishing plan of treatment may somewhat relieve the concomitant exhaustion of mollities ossium, and opiates alleviate the wearing pains. Posture, and mechanical contrivances, are also of some use in counteracting the progressive deformity, and rendering life more tolerable to the patient, when bedridden.

**FRAGILITAS OSSIUM.**—Brittleness of the bones is, pathologically, the opposite condition to Rickets; implying a superabundance of earthy matter in their composition.

Occurring as a natural change in the bones as life advances; it may also, at other periods, be symptomatic of cancer, syphilis, scurvy; and, probably, of other diseases of, or affecting, the osseous system.

#### TUMOURS OF BONE.

**Exostosis.**—*Structural Condition.*—Exostosis is an out-growth of bone, its texture therefore resembles either the compact or the cancellated structure of bone.

The *compact* variety, consisting of solid bone, is of small size, and is very hard—hence named *ivory-exostosis*. It is commonly situated on the flat bones, especially the cranium. This variety of exostosis—observes Mr. Paget—occurs in two forms. Some grow on the exterior of the bones of the skull, in smooth, spheroidal, or lens-shaped lumps, attached, commonly, by rather narrow bases. Others, which are usually of deeply lobed and nodular shapes, grow in the diploe, or the frontal or other sinuses, whence, as they enlarge, they project through the gradually thinned and perforated layers of bones that at first enclosed them. The former kind rarely increase to an inch in diameter; the latter may increase to many inches, and they commonly project into the cavity of the skull, as well as externally, or into the cavities of the orbits or any other adjacent parts.

The *cancellous* variety, consisting of the open medullary texture of bone, containing marrow, and invested with a very thin layer of compact tissue, is of considerable size, and yields somewhat under pressure. It is commonly situated on the shaft of a long bone; particularly the femur, on its inner surface, just above the condyle; the head of the tibia; or phalanges of the fingers or toes. Another very common situation—according to Mr. Holmes' observations—is beneath the deltoid muscle: but here I have never met with the cancellous variety of exostosis.

In both conditions, the structure of exostosis usually resembles that of the bones on which they, severally, grow. Exostosis generally occurs singly; but many may form, when they are usually symmetrical. This is particularly observed in the cancellous variety.

*Signs.*—The characters of exostosis are sufficiently obvious; a very hard, or a somewhat yielding, rather pedunculated tumour, immovable or nearly so; attached to the bone as an out-growth.

*Causes.*—The compact variety is attributed to syphilis, scrofula, or other diseases affecting bone, and which produce an out-growing hypertrophy of the compact osseous texture. The cancellous variety results from the ossification of an enchondromatous or cartilaginous tumour. It may, therefore, be said to be developed through cartilage;



while the ivory variety is rarely so produced. Age seems to have some causative relation to exostosis; both varieties commencing, probably, in earliest infancy.

*Course and Terminations.*—Both forms of exostosis are slow-growing, and particularly the compact variety; but the cancellous attains a far larger size. Both may undergo certain destructive changes; necrosis, or sloughing away from the bone, and occasion ulceration of the superimposed integument. Both also may occasion various functional disturbances by pressure. The situation of exostosis will very much determine these results. Thus, an ivory exostosis has projected into the orbit; or growing from the inner table of the skull has pressed upon the brain; or, from the pubic bone, has perforated the bladder.

*Treatment.*—Exostoses which remain stationary, or occur in certain situations, as the orbit, are better left alone. The danger also of exposing cancellated bone, should always be considered; diffuse suppuration and pyæmia being very liable to follow the operation of removal. Otherwise, an exostosis may be removed mechanically, by *excision*; or destroyed, by nitric acid or other strong *caustic*, applied to its exposed base.

Compact or ivory exostosis is often very difficult of excision. Several instruments should be provided; that one failing, another may prove efficient. A trephine, saw, chisel and mallet, or cutting pliers, are sometimes severally requisite to remove the little ivory-hard lump of bone. They all, in turn, failed in the hands of an expert operator—the late Mr. Keate—although employed perseveringly for nearly two hours. The exostosis having been removed down to its base, caustic may then be applied to destroy the remaining portion by exfoliation. Potassa fusa and nitric acid were thus applied successfully in Mr. Keate's case. Exostoses do not recur after removal; and, fortunately, even when the base of attachment is left, the tumour is not likely to grow again.

*ENCHONDROMA.*—In connexion with bone, enchondroma or cartilaginous tumour has already been considered, as being the most prominent part of the general pathology of this species of Morbid Growth (Chapter ii.); for it occurs principally in connexion with the osseous system. Enchondroma—or, occasionally, some other kind of growth—may be contained in the centre of a bone, and surrounded by an osseous shell or bony cyst; it is then sometimes designated “*bullous exostosis*,” especially by French Surgical authors.

*Treatment.*—Excision or amputation will be appropriate, according to the size and relations of the tumour.

*FIBROUS TUMOUR.*—The formation of a fibrous tumour in connexion with bone is far more rare than the cartilaginous tumour. It is, however, illustrated by epulis and fibrous nasal polypus; both of which are fibrous *out-growths*.

The *Signs* of any such tumour much resemble those of enchondroma; and their diagnosis is unimportant.

The *Treatment* is excision or amputation.

*CYSTS.*—Two kinds of cysts have been found in bone; the *serous* and *sanguineous*. Their pathology for the most part merges in the general history of these cysts (p. 85). They are *multilocular*, the cavities often communicating; and they are met with in the jaws or in the long bones—their shafts or articular ends. They grow to a large size, that of a cocoa-nut or fatal head. *Unilocular* cysts are also described by Nélaton as containing solid matter, of a fibrous or fibro-cartilaginous structure,

occupying entirely the cavity of the cyst. These are found in the same situations as the last, but grow to a less size. Cysts in bone occur mostly in adults.

*Signs.*—They produce an expansion of the surrounding osseous texture, and at length being enclosed in a thin lamellar capsule of bone, yield a crackling sensation under pressure with the finger and a deeper or more obscure elasticity or semi-fluctuation. Perforation here and there taking place by progressive absorption of the lamellar capsule, the enclosed tumour becomes more clearly perceptible. The superimposed skin yields before the increasing tumour; but without discoloration or any participation in the disease, and there is little or no accompanying pain. The tumour is thus plainly non-malignant in its development.

*Treatment.*—*Fluid* cysts may be laid open by removing a portion of the bone, by trephining or otherwise, and the cavity dressed from the bottom with lint. Granulation will then obliterate the cyst. *Solid* cysts must be excised, or recourse had to amputation; according to the size and relations of the cyst.

**CYSTIC TUMOURS.**—In bone, as in other parts, tumours occur, containing cysts. Fibro-cystic tumour of bone commences, apparently, in the cancellous tissue, and growing outwards, occasions fracture.

The *Signs* are those of cysts in bone; an elastic sensation or obscure fluctuation. The femur was the seat of the disease in four cases, one of which is related by M. J. Adams in the "Path. Soc. Trans.," vol. v., and the remaining three by Mr. Prescott Hewett, are appended to the report of that case. The absence of pain, integumental discoloration, and glandular swelling; distinguish this tumour and other innocent cystic tumours from Cancer. Amputation was followed by permanent recovery in the above cases.

**HYDATID-CYSTS** in bone, are interesting chiefly in relation to the *fluid* cysts, above described. The entozoon has been in all cases, the echinococcus or accephalocyst; except in one case, mentioned by Mr. Stanley, where the cysticercus cellulose was found in the interior of one of the phalanges. But hydatid-cysts are very rare; eight cases only being referred to in Rokitsky's work; to which a limited number of instances might be added. These cysts may be seated in a flat bone, as the skull or ilium, or in the expanded head of one or more of the long bones; cases of which are cited by Mr. Holmes.

The *diagnosis* with reference to ordinary fluid cysts, can scarcely be drawn. The cysts increasing in size, fracture occurs, as probably the first appreciable sign; and the bone remains ununited. This, however, is incident to other diseases of bone. A discharge of fluid containing entozoa would determine any question of diagnosis. This may occur spontaneously, or be obtained by puncture.

The *treatment*, also, is the same as for ordinary fluid cysts; but it will be advisable to destroy the interior of the hydatid cyst by freely applying nitrate of silver or other caustic.

**RECURRING TUMOURS OF BONE.**—The *Myeloid* form of Enchondroma, in connexion with bone, is sufficiently described in the general pathology and treatment of this growth.

Recurring *osteoid* tumour is illustrated by a series of three preparations in the Museum of the Royal College of Surgeons, to the remarkable history of which Mr. Holmes has called attention. A hard, and heavy, dry osseous substance formed around the ends of the femur and tibia, projecting into the knee-joint, extending far up the thigh and implicating

the popliteal artery, vein, and nerve, so as to cause œdema and severe pain. (Prep. No. 3244.) Amputation was performed at the thigh. The patient remained well for five years; then another osteoid tumour formed on the stump of the femur, accompanied with severe pain. Amputation was performed higher up. The tumour appeared to grow, not from the bone itself so much as from the periosteum, and enclosed the femoral artery. (Prep. No. 3245.) An interval of health again continued for two years; when another tumour formed about the stump, progressed upwards, out of reach of operation, and finally proved fatal, by inflammation and sloughing of its soft coverings, twenty-five years after the first appearance of the disease. The general health of the patient, a male, remained unaffected during the whole period. (Prep. No. 3245A.) Another, and very similar case, may be found in Mr. Paget's Surgical Pathology.

These cases of recurring osteoid tumours, certainly bear a remarkable analogy, in their course and tendency, to the recurring fibroid and fibro-nucleated tumours—varieties of fibrous tumour.

CANCER.—Each species of Cancer—*encephaloid*, *scirrhus*, *colloid*, and *epithelial* cancer, is liable to form in connexion with bone; but encephaloid is the most frequent. Like other diseases of bone, Cancer may affect the *substance* or the *surface* of a bone; in the one situation, it is known as interstitial or possibly central cancer, in the other, as periosteal cancer.

In the *substance* of bone, *interstitial* cancer occurs in the form of scattered nodules, having a whitish colour, and the consistence of scirrhus, or hard encephaloid cancer. The cancer-cell—so little absolutely characteristic of cancer—may be indistinguishable or absent. These nodules coalescing, form a mass, which occupies the cancellous tissue, and extends into the medullary canal. The bone surrounding such a formation is expanded and thinned or thickened; with osseous fibres traversing the substance of the tumour, radiating from its centre. It is situated most commonly, in the articular ends of a long bone, or in a flat bone, as the pelvis or skull. As affecting the whole bone, this condition of the disease is sometimes designated, *infiltrated* cancer of bone.

On the *surface* of bone, *periosteal* cancer forms between the bone and periosteum; rarely involving the one, while the other may sometimes be traced over the tumour. Osseous fibres radiate from the surface of the bone through the tumour; and a bony deposit forming a coral-like mass, often spreads around it. Periosteal cancer appears, usually, in the long bones, especially affecting their articular ends. The incrusting cartilage of the contiguous joint generally escapes, in both this, and the interstitial formation of cancer; although the disease may extend to the capsule.

*Osteoid* cancer is a term used to designate a further degree of ossification, than that commonly met with in interstitial and periosteal cancer-growths. This is analogous to the ossification of enchondromatous or cartilaginous, and fibrous, tumours. Osteoid cancer is described by Mr. C. H. Moore as being, in a well-marked case of the primary tumour, a large mass of the hardest enamel or ivory-like bone; the glandular disease is bony, though it may be less hard; and the disease disseminated in the soft internal organs, and protruding into the blood-vessels, is also in great part, osseous.

Any bone is liable to cancer-formation; but some are far more so than others. The femur and tibia are most subject to the disease, and particularly the articular ends of these bones at the knee-joint. Thus, of 20 cases of cancer of the long bones of the lower limb, 11 were situated near



this joint. The pelvis, spine, skull—especially the antrum and the humerus—are also seats of cancer.

*Signs, and Diagnosis.*—(1) Cancer in the *substance* of bone, produces expansion and an osseous tumour; but the nature of this tumour can scarcely be recognised at first. The enclosed encephaloid cancer is much harder than when this disease affects the soft parts. At length, the enclosing shell of bone yields, and the mass declares itself at once, or very shortly, as the tumour unrestrained, grows more rapidly. The ordinary characters of an encephaloid tumour become apparent; its soft consistence, lobulated contour, and large size; with purple discoloration of the skin, enlarged, ramifying veins, and pain throughout the course of the disease. Pulsation, of a thrilling or blowing character, may become perceptible, owing to enlargement of the vessels in the tumour, as it undergoes development. Fracture often occurs at the affected part. Glandular swellings and constitutional symptoms will confirm the diagnosis.

(2) *Periosteal* cancer presents a tumour of more clearly cancerous character, and it grows more rapidly, at an earlier period. The muscles attached to the bone often become extensively infiltrated with cancer-cells.

Thus may Cancer in, or on, bone, be recognised and distinguished from any other species of tumour. The diagnosis of malignant and non-malignant tumour of bone, lies, however, principally between *encephaloid* cancer and *enchondroma*. Here the presence, or absence, ultimately, of the signs which indicate an extension of the disease to the integument and neighbouring lymphatic glands, will mainly determine the question. Puncture with a grooved needle is also available as a critical method of examination, in this case, no less than in other doubtful forms of tumour. I was thus enabled to determine the nature of a tumour at the lower end of the femur close to the knee-joint; which in point of consistence and lobulated appearance, much resembled enchondroma. Amputation was performed, and the mass proved to be encephaloid.

*Pulsating* encephaloid may be distinguished from *aneurism* by the expansive, heaving character of the latter, as compared with the thrilling vibration of the former.

*Treatment.*—*Excision* will be appropriate only in cases of limited cancer-growth in, or on, bone; and when situated where the whole diseased portion can thus be removed. But under, apparently, the most favourable circumstances of limitation, the operation itself may prove most *perilous*. I once assisted my colleague, Mr. De Meric, in removing an, apparently, moveable tumour, the size of a small orange, and situated over one of the mid-ribs. But this little mass sprang from the bone, the rib readily broke, and the welling up of blood from the tumour—an encephaloid cancer—was so profuse, that the patient nearly died on the spot. He sank in a few days from hæmorrhage into the pleura.

*Amputation* must generally be resorted to. This operation should be performed in the earliest recognised condition of the disease, and certainly before any enlargement of the lymphatic glands has evinced the super-vention of systemic infection. Moreover, removal by amputation can only be effectual for the prevention of the recurrence of cancer, when the operation is performed high above the part affected so as to be entirely free of the seat of the disease. Hence, in *interstitial* cancer of bone, the line of amputation should be—not in the continuity of the bone—but above the next joint; and in *periosteal* cancer the line will be most

judiciously selected even higher up, above the origins of the muscles infiltrated probably by proximity to the disease.

**PULSATILE TUMOUR of bone, and OSTEO-ANEURISM.**—*Structural Conditions.*—A pulsating tumour in, or on, bone, may be—(1) a tumour, *not itself* pulsating, but in connexion with an artery which communicates its pulsations thereto; as, an enchondromatous, fibrous, or other tumour, thus connected; (2) a *vascular* tumour; usually cancerous, and particularly, encephaloid in the course of its development; (3) a *vascular growth* or erectile tumour of bone, resembling aneurism by anastomosis in the soft parts, and constituting *osteo-aneurism*. This last condition is very rare, if it exist at all; and the best authorities, such as Cruveilhier and Rokitsansky are agreed respecting the rarity of osteo-aneurism, and that most pulsating tumours of bone are highly vascular encephaloid tumours.

The situation of any such tumour is generally the *cancellous interior* of a bone, especially of the long bones, at their articular ends; as the femur, tibia, humerus, radius; also in the flat bones; as those of the pelvis and skull, and in the ribs.

*Signs, and Diagnosis.*—An enlargement of the bone, with a thrilling pulsation and bruit, are symptoms common alike to a highly vascular tumour, such as advanced encephaloid cancer, or aneurism by anastomosis. And, this pulsation subsides on compressing the main artery of the limb. But the persistence of a tumour, and its incompressibility, would be distinctive of a mass having formed independent of the blood-vessels, a *vascular tumour*, and not a *vascular growth* or enlarged congeries of vessels. The bony case, however, which encloses any such tumour renders this test inapplicable, until the bone yields and the mass protrudes on the surface of the bone. Or, compression of a main artery may be impracticable, owing to the situation of the tumour, as in the pelvic bones. Or again, the supply of blood may come from so many arterial branches, that it cannot be arrested by compression. A tumour pulsating in *connexion with an artery* is also distinguished in like manner.

Subsequently, the nature of the tumour will be still further declared by its more developed characters; encephaloid cancer, for example, enlarges rapidly, and involves the skin and lymphatic glands.

*Treatment.*—Having due regard to the almost exclusive cancerous nature of pulsating tumour of bone; *excision* must have the same restricted applicability as with regard to cancer of bone in general. This operation has failed in cases of cranial and scapular pulsating tumours.

*Amputation* is the only justifiable operation of removal, in other than the few exceptional cases alluded to. The more decidedly encephaloid the disease, the more appropriate will be this more sweeping operation. It should be performed as soon as the nature of the disease is declared, and the line of amputation be chosen above the joint nearest to the bone affected.

*Ligature* of the *main artery* leading to the part is said to have proved successful in some cases; but probably not in pulsating tumour of bone having an encephaloid character. Compression might be tried previous to ligature.

**DISEASES OF PARTICULAR BONES.**—**CRANIAL BONES.**—*Caries* and *Necrosis* of these bones are liable to occur, as one of the local manifestations of Scrofula or of Syphilis. Commonly affecting the arch of the skull, and particularly the frontal bone; the ethmoid and sphenoid bones do not escape. The temporal bone seems specially prone to scrofulous caries.

The *structural condition*, and *signs*, are both described under the

general pathology of Caries as affecting the *surface* of Bone, and of Scrofulous and Syphilitic Otitis, and *exfoliation*.

The *causes*, most frequently constitutional, are sometimes traumatic; as exfoliation resulting from a contused wound of the scalp, or other injuries of the head.

The *course* of either state of disease is important with reference to the probability of cerebral complications; meningitis with effusion, convulsions and coma, being apt to supervene and terminate fatally. Caries of the petrous portion of the temporal bone, as a form of Scrofulous disease, is more particularly dangerous. Ear-ache with chronic suppuration leads to perforation of the tympanum; the ossicula crumble, loosen, and are washed out by a profuse fetid discharge, exposing the dura mater continuous with the cavities of the ear. If the disease be not fatal, permanent deafness results.

*Treatment*.—The local measures for the removal of carious or necrosed portions of bone by operative interference, and the constitutional treatment of Scrofula or Syphilis, are in no way peculiar to the Cranial Bones.

DISEASES OF THE JAWS will be considered, under this title, in connexion with Diseases pertaining to the HEAD.

DISEASES OF THE SPINE.—See SPINE.

## JOINTS.

### CHAPTER XXXII.

#### INJURIES.—SPRAINS.—WOUNDS.—DISLOCATIONS.

SPRAINS OR STRAINS OF THE LIGAMENTS OF JOINTS.—These lesions essentially resemble similar injury of TENDONS [ch. xx.]. The *ankle* or *wrist-joint* is most commonly affected. Severe pain, possibly inducing syncope, is soon followed by swelling around the joint; succeeded by stiffness, and continued inability to use the joint. A very severe sprain, or its repetition, may leave the joint in a state of permanent weakness, and liability to dislocation. Or disease of the joint may ensue, in persons predisposed by any constitutional condition, as a rheumatic or gout diathesis. And it would seem that injury to a joint so alters its structural condition as possibly to induce disease under favourable circumstances; and perhaps after the lapse of a considerable period. Thus, Sir B. Brodie, shortly before his death, I believe, suffered from a malignant tumour of the shoulder, which was, apparently, referable to some textural disorganization consequent on dislocation of the joint some years previously.

The *cause* of sprain, is a violent and sudden twist or wrench of a joint, whereby the opposing ligaments are stretched or somewhat ruptured.

The *treatment* consists in an easy position and rest, warm or cold applications, according to the inflammatory character of the swelling and the feelings of the patient; followed by stimulating embrocations, and the support of a bandage, broad strips of plaster, or a starched bandage.

WOUNDS OF JOINTS.—A wound extending into a joint may, like other Wounds, be *incised*, *punctured*, *contused*, or *lacerated*; and the joint,



accordingly, is more or less opened, or extensively injured. But, the admission of air into the joint chiefly determines the importance of any such lesion; and thus the pathological condition of these different wounds must be estimated by this consideration. The extent of the synovial membrane, or the size of the joint should also be taken into account.

*Signs and Symptoms.*—The escape of synovia from the external aperture, or an exposure of the interior of the articulation; are the only pathognomonic or absolute signs of a wound into a joint. Synovial fluid is recognised by its translucent, viscid, albuminous character, resembling raw white of egg; the interior of a joint presents the additional characters of glistening synovial membrane and cartilage, and the peculiar disposition of the articular surfaces. But these appearances should be discovered by inspection, or gentle introduction of the finger; an exploring instrument might penetrate the synovial membrane, and cause a wound not otherwise existing.

Inflammation of the synovial capsule rapidly supervenes, presenting the usual appearances of synovitis, but distinguished by two peculiarities; the *intense* pain, and *more acute* constitutional disturbance. Suppuration also is almost inevitable, with hectic, and irreparable destruction of the articular surfaces constituting the joint; or pyæmia intervening at an early period, proves fatal. In two cases, under my care in the Hospital, wounds of the knee-joint exposing the articulation, both terminated in this way.

*Treatment.*—Preservation of the limb—without any operative interference—should always be attempted, in the first instance. But the probability of success will depend chiefly, on the nature of the wound, and the extent of the synovial membrane or the size of the joint. A small incised wound or puncture, in a small joint, as one of the finger-joints, allows of preservation with great probability of success; a large, open, and perhaps contused wound, in a large joint, as the knee, is almost surely fatal to limb and life. Among large joints, however, those of the upper extremity—the shoulder, elbow, and wrist, are, commonly, more favourably disposed, than in the lower extremity—the hip, knee, and ankle. To save a joint, the wound must be at once closed, thus to solicit union by primary adhesion. A pledget of lint or piece of isinglass-adhesive plaster, may be used for this purpose; or I would try the dressing with carbolic acid paste on tinfoil, according to Mr. Lister's plan under similar circumstances. Repression of inflammation can sometimes be accomplished by rest and cold evaporating lotions.

Synovitis having proceeded to suppuration—the synovial capsule having become converted into an abscess, the joint should be laid freely open by incisions, as advocated by Mr. Gay; and a position of the limb secured favourable for its utility, in the event of irreparable destruction of the articulation followed by ankylosis.

Destruction of the joint, without this issue, must be met either by *excision* of the diseased bone, or by *amputation* of the limb. The choice of these alternatives should be determined by a due consideration of the local and constitutional conditions. Fortunately, *traumatic* arthritis, as proceeding from the synovial membrane to the adjoining cartilages and bones, seldom engages these structures beyond the range of excision. But, the constitutional exhaustion may be so severe, as to compel recourse to secondary amputation, rather than peril life by the slow recovery consequent on excision. Or, amputation may become necessary,—and then without an alternative—*after* excision.

*Primary* amputation, it would thus appear, should not be resorted to in any case. But, in its preventive relation to pyæmia, more especially, it is questionable whether this operation might not be justifiable, occasionally. An open, and perhaps *contused*, wound, of a *large* joint, as the knee, represents conditions which may justify immediate amputation. In my two knee-joint cases life might, probably, have been saved by such timely intervention.

Fracture involving the joint, or dislocation, as complications, in similar cases, mostly demand immediate amputation.

*Wounds of Particular Joints* are to be regarded in accordance with the general pathology and treatment of this kind of Injury.

#### DISLOCATION.

**DISLOCATION.**—*Structural Conditions.*—Dislocation is a displacement of the articulatory portion of a bone from the surface on which it was naturally received; accompanied by more or less laceration of the ligaments or other surrounding structures. Dislocations differ essentially in

FIG. 155.



regard to the mode of their reparation, according as they are unaccompanied, or attended, by an open wound communicating with the dislocation; the one being termed *Simple*, the other *Compound*. *Complicated* Dislocation is also a recognised distinction, signifying the concurrent injury of some other part. But this is not an essential condition, as pertaining to Dislocation. *Congenital* Dislocation arises from malformation of the joint affected. In respect to the extent of displacement; dislocation may be *incomplete*, as hinge-joint dislocations not unfrequently are; or *complete*, as those of orbicular joints usually are (Fig. 155), this difference being due to the particular shape of the articular surfaces. The primary displacement is made more complete, especially in orbicular-joint dislocations, by tonic contraction of the muscles, subsequently.

*Signs.*—Dislocation is attended with a corresponding defacement or deformity of the *outline of the joint*; as represented by dislocation of the shoulder-joint, downwards into the axilla. (Fig. 156.) The natural prominences of bone near the articulation either disappear, or are less conspicuous, as the great trochanter at the hip-joint; or they may be more prominent, as the acromion, in dislocations of the shoulder. The *length of the limb* is altered, and especially if the dislocation be complete. Elongation, or shortening, is produced; according as the head of the displaced bone happens to be lodged below, or above, the level of the articular surface on which it naturally moves. The possibility of either, or of only the latter, alteration of length taking place, is determined by the form of the articulation. An orbicular joint allows of dislocation in any direction from its circumference; upwards, downwards, forwards, backwards. Hinge-joints cannot allow of displacement in more than three directions; backwards, forwards, and laterally, to the right or left. The *direction* of the dislocated bone, and thence of the *limb* below, is characteristic. Certain muscles being thrown out of action, by displacement of

the portion of bone to which they are attached ; others thus acquiring a mechanical advantage, preponderate. The natural balance of opposing muscles, as flexors and extensors, is lost, and the limb acquires that particular attitude to which the predominant muscles direct it. To these positive signs, may be added two negative ones; *immobility* of the limb

FIG. 156.



which gradually supervenes, in proportion to the tonic contraction of the muscles ; and also the *absence of crepitation*. Pain, and inability to use the limb, are *functional* symptoms of Dislocation, but of equivocal value for an early and exact diagnosis. [P. p. 173.]

*Diagnosis.*—The pain may be insignificant at first, before swelling supervenes ; and in oft-recurring dislocation, where the ligaments and muscles are weakened, and especially in an old feeble subject. The power of motion may be retained under similar circumstances, for the tonic contraction of the muscles is insufficient to fix the limb. But if both pain and powerlessness are present, they may each arise from other causes than dislocation ; from fracture, a bruise, or rheumatism. The *physical* signs of Dislocation, are, *severally, more* sufficient to determine the diagnosis, than in the case of Fracture. The signs alluded to are, each, in various degrees, invariably present, and are almost exclusively connected with Dislocation.

It is only as compared with Fracture in the neighbourhood of a joint, that Dislocation can be confounded. But, firstly, the outline of the joint is different, otherwise than in exceptional cases. Thus, dislocations of the hip-joint may be distinguished from fracture of the neck of the thigh bone, by this sign ; so also, dislocations of the shoulder-joint, as compared with fracture of the anatomical neck of the humerus. Then again, as to alteration of the length of the limb ; elongation is always peculiar to dislocation—shortening may, however, be due to unimpacted fracture with displace-



ment. Fracture may, thus, simulate dislocation upwards, in orbicular dislocations; or dislocation, forwards or backwards, in hinge-joint dislocations. It is, therefore, only between *ordinary* cases of fracture and *certain* dislocations, that the diagnosis by this sign is equivocal. The direction or attitude of the limb is always peculiar to dislocation. Lastly, the crepitation and mobility of fracture, are both absent with dislocation. So far, physical signs, severally, supply an exact diagnosis. As immediate signs, they are of equal value for an early diagnosis; excepting, perhaps, in regard to one physical sign—immobility of the limb. Tonic muscular contraction, whereby a dislocation becomes fixed, takes place slowly; and immobility, therefore, can scarcely be regarded as an early sign of dislocation. In one case, a dislocation of the femur into the foramen ovale was examined by Sir A. Cooper, a few minutes after the accident; the limb was still very moveable, and continued so for the space of nearly three hours, when it became fixed.

If then, the physical signs of Dislocation, are, severally more diagnostic than those of Fracture; *collectively*, they cannot fail to establish the diagnosis of this injury.

*Causes, and effects of Dislocation.*—Dislocation is produced, in general, by external force, suddenly applied. *Predisposing* causes are, however, very influential. Some such causes are functional actions depending on anatomical conditions; as the shape of the articular surfaces allowing a free range of motion, laxity of the ligaments retaining them, and the powerful action of many muscles on a long lever-like bone. All these predisposing conditions are combined in the shoulder-joint, and less so in the hip. Hinge-joints being more favourably circumstanced anatomically, are less liable to dislocation. Other predisposing conditions are acquired by disease; and these also have reference to the cartilage and head of bone, which may be destroyed by ulceration and caries; to the ligaments, as loosened by this process; or to those muscles which naturally aid in retaining the articular surfaces in apposition, but, which may have become wasted and enfeebled, or paralysed.

Dislocation itself operates as an internal cause of constitutional disturbance, by producing shock in a greater or less degree, followed by reaction; or, this, accompanied with shock, as prostration with excitement; which may be succeeded by Tetanus. [P. ch. ix.] But simple Dislocation is *essentially* local in its effects, and does not necessarily cause any persistent constitutional disturbance.

*Repair.*—The ruptured ligaments, and tendons if any be torn, are disposed to re-unite by primary adhesion; without inflammation. Lymph is effused which speedily passes into fibrous tissue, through the medium of nucleated blastema. Any superfluous reparative material, and the blood extravasated by the injury, are absorbed; and thus the concomitant swelling subsides. The joint is ultimately restored to nearly its originally perfect construction. This presupposes the previous *reduction* of the dislocation.

If the bone remain dislodged from its natural articulatory surface or cavity, then a *new joint* is constructed, the mechanism of which, however, is more or less complete, according to the kind of texture on which the bone has found a resting-place. If lodged on *muscle*, it gradually burrows for itself a convenient nest, the two surfaces become mutually adapted to each other, and, a capsular ligament being formed of condensed cellular texture, an imperfect joint is established. But if the displaced bone be lodged on *bone*, this loses its periosteum, and that its articular cartilage;

a receptacle is excavated suitable to the impression of the articular surface; a bony rim or lip is thrown up by the periosteum around the margin of this newly formed cavity; the surrounding cellular texture, moreover, becomes condensed into a capsular ligament, which further provides against any displacement; and thus a far more perfect joint is constructed. (Fig. 157.) In either case, the muscles which act on the dislocated bone retain it in its new position, and, becoming permanently shortened, their lines of action get accommodated to the displacement. The track through which the head of bone passed is now filled up with plastic lymph, and the ligaments, perhaps, have become adherent to the neck of the bone; the original articular cavity loses its cartilage and closes in, undergoing also partial obliteration by a dense fibrous deposit. This articular transformation is well shown in specimens—rarely procured—of unreduced dislocation of the hip-joint. Implying, as it does, an irretrievable sacrifice of the articular cavity, the work of destruction, in any case, proceeds very slowly; Nature effaces the original articulation reluctantly.

FIG. 157.



The *Prognosis* of reduced Dislocation is favourable, with regard to re-union of the ruptured ligaments, and the tendons if any be torn; their reparation by adhesion being subcutaneous, and not affected by exposure to the air as in the healing of an open wound.

But the prognosis must be determined by a due consideration of all those internal causes, which either aid the recurrence, or may prevent the original reduction of Dislocation; and which are, moreover, *persistent* in their tendency to perpetuate the displacement.

Causes of *recurrence* may be noticed first, they being among the conditions already mentioned as predisposing to Dislocation. Some of these conditions are, as we have seen, anatomical; a patulous shape of the articular surfaces, laxity of the ligaments, and a long lever-like bone, on which many muscles act. Hence dislocations of the shoulder-joint are specially apt to recur, and less so hip-joint dislocations. Hinge-joints are, anatomically, less disposed to re-dislocation. Other such causes are morbid conditions; ulceration of the articular cartilages, and caries of the adjoining bone, relaxation of the ligaments, a weakened or paralytic condition of the muscles. Of causes *opposing* reduction, may be mentioned, the anatomical shape of the articular surfaces; as the prominent rim of the acetabulum, in hip-joint dislocations, and the cup-shaped head of the radius which is locked in front of the humerus, in dislocation of that bone forwards. Any ligaments which may not have yielded with dislocation, seem to bind down the bone; as the first phalangeal bone of the thumb when dislocated upon its metacarpal bone. Tonic contraction of the muscles can scarcely be regarded as an unconquerable source of opposition; but the structural change of the muscles which accompanies their permanent shortening and functional adaptation, in unreduced dislocation, is a condition of resistance, not to be overcome judiciously by

forcible reduction; and less so in proportion to the duration of this condition. The prognosis is that of *unreduced* dislocation, with the formation of a new or substitute-joint.

*Treatment.*—After Dislocation, especially of the orbicular joints, the muscles which favour the particular displacement, draw the head of bone into its new position, and there fix it; but, this displacement, and subsequent fixation, are accomplished *gradually*. The head of the humerus, for example, having been displaced forwards, by the violence which caused dislocation; it is then drawn inwards, and eventually, there fixed. But, *immediately* after Dislocation, the muscles are always partially paralysed by the shock to the nervous system consequent on the injury, and for a short period they remain powerless. Subsequently, their tonic contraction comes into operation. Therefore, at the time of dislocation, and soon after, the displacement, caused by muscular action, can be easily replaced; and any resistance, of this kind, may be *partly* neutralized by a position suitable to the further relaxation of the antagonistic muscles. This then is the earliest condition of dislocation, ere the muscles complete the displacement; and this the most favourable opportunity for its reduction, when the muscles are as yet *powerless*. Thus, immediately after a dislocation of the femur backwards, Liston, having this opportunity, immediately reduced it, on the spot, without pulleys, or even the help of an assistant.

If Dislocation be overlooked or neglected, for a few hours, the muscles will have then become more immovably adapted to their new lines of action; subsequently, they become shortened also; a new joint is in process of formation; the track through which the head of bone has passed is occupied with plastic lymph; if the rent in the ligaments be small, this aperture tightly embraces the neck of the displaced bone, which becomes adherent and more fixed; and lastly, the natural articular surface or cavity gradually undergoes obliteration. Replacement is, at length, scarcely practicable, if possible, and certainly not to be accomplished without endangering many structures; muscles, nerves, vessels, and perchance the bone itself; nor without re-opening the track through which the head of bone had passed, and re-rupturing the ligaments; and even then only to find the natural articular cavity effaced or obliterated. Delay, therefore, proportionately precludes replacement by any conservative surgical interference.

The rules of treatment are precisely analogous to those relating to Fracture.

(1) *Coaptation* or replaced position of the displaced head of bone, in relation to its natural articular surface or cavity. This implies a *suitable position* of the limb, as far as *possible*; to relax the antagonistic muscles which, by their tonic action, retain the head of bone in a displaced position, and resist its replacement. But coaptation also implies, *extension* and *counter-extension* of the limb; sufficient only to bring the head of bone parallel to its natural articular surface or cavity; the *reduction* of dislocation. Coaptation is then readily effected.

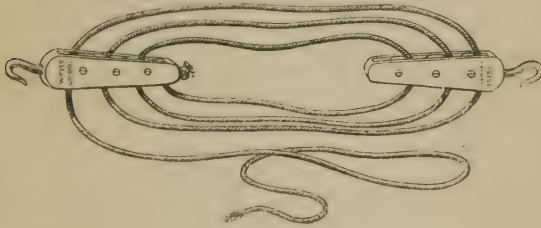
(2) *Maintenance* of coaptation, during the reparative process of reunion of the torn ligaments, tendons, &c. This still pre-supposes a suitable position; not, however, with the view of relaxing such muscular contraction as maintains coaptation, but for the prevention of re-displacement by the spasmodic action of antagonistic muscles. But it also implies the employment of suitable *retentive appliances*; and both, to



ensure *rest*. This is, obviously, only the continued fulfilment, and completion, of the former rule of treatment.

The *Reduction* of Dislocation is a *process*; in this respect differing from the reduction of Fracture, which is readily effected. In Dislocation, however, reduction must be accomplished by retracing the displacement which has been caused by the muscles in operation; the head of bone being conducted, through the course it has thus taken, back to the point where muscular action began. Tonic contraction of the muscles will then effect coaptation. It is in retracing the *course* of displacement—the performance of reduction, no less than as regards the *timeliness* of Surgical intervention, that the guidance of pathology is chiefly experienced in the treatment of Dislocation. To facilitate reduction, muscular resistance is eluded, partly by undertaking reduction as soon as possible after dislocation, when the muscles are as yet inoperative; and partly by placing the limb in a suitable position, as far as possible, to relax the antagonistic muscles. The *semi-flexed* position, as nearly as it can be attained, is the happy medium, generally desirable for this purpose. In hip-joint dislocations, flexion of the knee relaxes the three ham-string muscles; while, for dislocations of the knee, the gastrocnemius muscle also, is thus relaxed. For shoulder-joint dislocations, flexion of the elbow relaxes the biceps muscle. And it should be re-

FIG. 158.



membered, that the flexor muscles are always stronger, and, therefore, more resisting than extensors. The resources for subduing muscular resistance will be noticed presently, in speaking of the act of reduction. *Extension* and *counter-extension* of the limb are necessary in all cases, and more especially for the reduction of ball-and-socket dislocations. The extending force may be either manual—as exerted by the Surgeon with an assistant or more; or mechanically applied, by pulleys. (Fig. 158.) Manual extension is less steady and less enduring; and as those who are so employed become fatigued, they relax their exertions, the muscles engaged in the dislocation regain their original supremacy and draw the bone back again to its former abnormal position; reproducing the displacement, and the work of extension has to be done all over again. Extension by means of pulleys is, however, apt to become too forcible, thereby endangering muscles, nerves, vessels, and even the bone itself; but force applied by this means can be better directed than that of personal strength. In like manner, counter-extension may be maintained either by an assistant or more; or by mechanical resistance, a cloth or strap being secured to some fixed point, as a staple firmly fixed in a wall. The relative merits of these two means of counter-extension also should

be estimated by the respective characters of the forces, which are thus applied. As a general rule, pulleys are required only to reduce hip-joint dislocations. When employed, precautions should be taken that the integuments of the part to which the force is applied, are not injured.

FIG. 159.

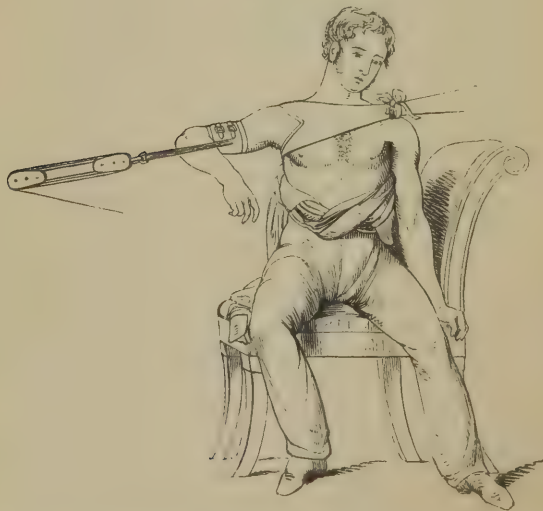


Extension may, therefore, be applied to the limb through a belt, padded with soft leather. If a strong woollen cloth be used instead, the noose should be fixed around the limb by the *clove-hitch* tie, which retains its hold securely, without tightening. (Fig. 159.) Besides this provision against strangulation, a damp cloth, under the noose, will protect the skin from friction.

To what *part* of the limb should extension be applied? On this point, opinions are divided, as with regard to fracture. Some of the most eminent French Surgeons have recommended extension to be made *indirectly*, from the distal extremity of the limb; from the wrist, in shoulder-joint dislocation; from the ankle, in that of the hip-joint. It is alleged that the advantage thereby gained

is twofold. The muscles are not excited to spasmodic action, as they would be were force directly applied to the dislocated bone; and that besides this negative advantage, there is also the positive advantage of

FIG. 160.



a longer lever, wherewith to act on the dislodged head of bone. The English School, represented by Pott and Sir A. Cooper in this branch

of Surgical Practice, and supported by equally distinguished Continental Surgeons, as J. L. Petit, Duverney, Malgaigne, and Callisen; have advocated extension *directly*, from the dislocated bone. Thus, from the arm, when the humerus is dislocated (Fig. 160); from the thigh, when the femur is dislocated. This direct application of extending force avoids endangering the intervening joints, and tells more effectually on the displacement. Certain it is also, that a long lever is not requisite for any truly Surgical purpose. If the muscles be relaxed, no such mechanical advantage can be necessary; if not relaxed, muscular contraction can be so directed as to eventually complete the reduction without the aid of a long lever. Moreover, assuming the obvious advantage of a semi-flexed position of the proximal joint below the dislocation; this position will necessitate the application of any extending force directly to the dislocated bone. Counter-extension is most effectual when applied as directly as possible, namely, from the surface corresponding to the dislocation.

Supposing counter-extension to be rightly adjusted, extension should be made first in that *direction* which the bone has assumed by dislocation. The head of the bone is thereby made to retrace its course, and is finally replaced without any additional laceration of the textures. Then again, the extending force should be equable, not jerking, and gradually increased; accompanied, of course, by counter-extension, equal, and in the opposite direction.

Any *voluntary* muscular resistance on the part of the patient, during reduction, is subdued by diverting his attention. A question now and then, as to how the accident happened, may answer this purpose, if no other; and by inducing our patient to speak, we overcome any advantage which the muscles attached to the thorax, would otherwise have, were the chest fixed, as when the breath is held. This point of practice is, obviously, important in reducing dislocation of the shoulder-joint. *Tonic* muscular contraction is most surely overcome by the slow inhalation of chloroform; but this should not be resorted to in the *first* instance. Supposing increasing extension prove ineffectual, and that any further degree of such force would, or might, endanger the muscles, nerves, or vessels; *then* only, in my opinion, is the administration of *chloroform* justifiable, for then only is the occasional peril of its action warrantable as our next resource. We thus steer clear of two risks; the former concerning the limb, the latter, the life. Any postponement of reduction, would not be sanctioned by pathology; for the muscles would become more unyielding, and the head of bone, more fixed, until indeed a new and moveable articulation was established, and the natural one effaced; a twofold condition which would utterly forbid even the attempt at reduction. But if *prior* to this result, we fail at the time of our first attempt, and followed up with the relaxing aid of chloroform; what then? I omit the objectionable measures formerly resorted to; nauseating doses of tartarized antimony, and the perhaps irrecoverable loss of the vital fluid by copious venesection, in the erect position and from a large orifice to speedily induce cerebral syncope. The *warm bath* may prove sufficiently relaxing; but this failing, we are compelled to accept the only alternative, that of waiting until the immediate consequences of extension have passed off, and then to renew it; aided by the repetition of chloroform, the warm bath, or both these relaxatives, successively. This second occasion, fairly tried, should be our last by increasing-extension; yet it is not our last resource. *Unreduced disloca-*



tions, of some duration, and not reducible by ordinary extension, prolonged even for an hour or two, have sometimes been reduced by *tiring* the antagonistic muscles; simply by attaching a trifling weight to the limb for a few hours. This tiring-extension is quite safe, as regards both limb and life, and would, therefore, whenever practicable, be far preferable to increasing-extension under the influence of chloroform; but, if it fails, the muscles will have gained considerable advantage by the further delay, and by the consolidation consequent on inflammatory effusion. While, therefore, tiring-extension might be a valuable *safeguard*, probably an assistant, in the intervals of a first and second attempt at reduction by increasing-extension, aided, if necessary, by chloroform; as an *extra resource*, it is most eligible in old dislocations, where that mode of reduction would be dangerous or useless. "The younger Cline, in this way, succeeded in reducing a dislocation of the shoulder which had been out for several weeks and could not be replaced in the ordinary way. Having fixed the shoulder, a brick, attached to the hand, was suspended over the end of the bed. On visiting his patient next day, the bone had returned to the socket."<sup>\*</sup>

In the course of extension, and especially towards its completion, it is the practice of some surgeons, to *rotate* the dislocated bone, so as to *forcibly* clear away any adhesions in the path along which the displaced head of bone should return home. But this forcible detrusion of any and every obstacle is prejudicial or unnecessary. It is neither conservative nor the teaching of pathology. Guided by a sufficiently exact knowledge of the relative position of the parts, as disarranged by the particular dislocation and as affected by the process of inflammation; the Surgeon is enabled to direct the bone aright in the path it *should* go—to retrace its course peacefully—without thus, as it were, knocking on the head, right and left, these supposed obstacles. And if such obstacles have become established, in an old unreduced dislocation, then indeed it is very questionable whether reduction should be attempted, and certainly not accompanied with the rupturing force of rotation.

*Coaptation*, following adequate extension, is the next, and final step, after reduction, which it may be said to complete. The displaced head of bone has been reduced, or brought back to that point where the muscles first began to operate, and where it was situated immediately after the displacement as effected by the violence which dislodged the bone. It stands on the brink of its natural articular surface or cavity; the one ready to regain, the other to re-establish, the articulation. This final step, it is now the duty of the Surgeon to *observe*, or to *undertake*, by coaptation—a manipulation analogous to the setting of fracture. Surgical assistance is needed according to the resistance offered by the shape and attitude of the two articular surfaces to be brought together. Rarely, the ligaments are obstacles; solely, or additionally. The head of bone may only need *guiding* to its proper place, into which the muscles, if not too much relaxed, will draw it; or, it may require to be *lifted* over the brink of the articular cavity, if this, its margin be prominent; as that of the acetabulum, in relation to dislocation of the head of the femur. Direct manipulation is, however, more generally necessary in the coaptation of hinge-joint dislocations; while, in ball-and-socket dislocations, the displaced bone is more usually guided into its hole, by properly

\* System of Surgery, Chelius, vol. i. p. 766, note by South.

directing the axis of the limb, towards the finish of extension. The ligaments scarcely ever resist. They are, in most cases, extensively torn; the capsular ligaments especially so. Any ligament peculiar to the joint, is also generally torn through, as the round ligament in hip-joint dislocations; but—according to the observations of Sir A. Cooper\*—if one such ligament remain entire, it may occasion difficulty in the reduction, as he experienced with respect to the knee and ankle joints. In dislocations of the latter joint, it is often necessary to twist the foot, in order to relax the untorn ligament, before reduction can be effected. In dislocation of the proximal phalanx of the thumb on the posterior aspect of the metacarpal bone, it may be necessary to *divide* subcutaneously, one of the lateral ligaments; the external being most easily reached. This operation was successfully practised by Liston,† in two cases; in an old man, much intoxicated, and a boy, after fourteen days' dislocation. In the latter case, the dislocation was reproduced accidentally, a week afterwards; but *then* the reduction was readily effected—thus showing that the resistance previously was unquestionably due to the undivided ligament. In all cases, coaptation should be guided by a due knowledge of the pathological conditions, and not effected by mechanical violence.

Coaptation is announced by a snap, a jerk, or sensation of something having given way; this being the signal that the muscles have done their duty by drawing the head of the bone home. If, therefore, the muscular system be paralysed, as under the influence of chloroform, or if the particular muscles engaged be weakened by prolonged extension, or extension be overpowering at the time of coaptation; in either case, the usual signal cannot be given. The Surgeon will wait in vain for any such announcement of coaptation, and he cannot reasonably expect this evidence of its having taken place. But the limb immediately assumes its natural length and attitude, as in repose; and the natural *contour* of the joint is recovered. The latter sign is the one most available in practice; for, the natural length and shape of the limb cannot be compared otherwise than by suspending extension, a cessation of effort which would at once undo all that had been gained, if coaptation be not accomplished. The natural *mobility* of the limb is immediately regained with coaptation; and this sign, *coupled* with the anatomical characters just mentioned, plainly declare that the natural articulation is restored.

Being thus assured of this event, the Surgeon need do but little more. Muscular contraction, having finally brought the bone into place, retains it there. Unlike fracture, the reduction of which is accomplished easily, but maintained only by watchful care; dislocation is reduced only by watchful care, after which, the muscles take care of the joint.

To *maintain coaptation*, it is necessary only to fix the limb, and in a suitable position for the relaxation of any muscles which by their action might re-dislocate the bone. This indication is easily fulfilled by securing the limb with a bandage; the arm to the chest, the leg to its fellow. Position and immobility are the more requisite on behalf of shallow joints, and if the ligaments are naturally loose; both of which conditions characterize the shoulder-joint. The twofold precaution of position and immobility is yet more necessary on behalf of *any* dislocation; when the muscles which usually prevent its recurrence, are themselves naturally

\* Dislocations and Fracture of Joints.

† Practical Surgery, 1846.

flabby and weak, or have been weakened by the dislocation, and by the extension necessary for its reduction. If, in such case, the limb be not securely fixed and supported in a suitable position; it may re-dislocate itself, not so much by the action of antagonistic muscles, as by the mere weight of the limb.

*Rest* of the limb, thus retained in position, will also favour the subsidence of any inflammation which may have supervened. But, the inflammation being subcutaneous, it terminates in resolution, very rarely in suppuration. Any so-called antiphlogistic treatment, therefore, is as seldom necessary; certainly not of a constitutional character, and locally only, by the application of a cold lotion in the first instance; with subsequently friction daily to revive the dormant muscles. Ample time must be allowed for firm re-union of the ligaments or other lacerated textures; failing which, the joint will be permanently weakened and ever liable to re-dislocation. On the other hand, judicious exercise of the joint, by passive motion occasionally, will prevent the tendency, otherwise, to some degree of ankylosis and permanent stiffness; with the irrecoverable loss of muscular power in the limb.

**COMPOUND DISLOCATION.**—*Structural condition, and Diagnostic characters.*—Compound Dislocation is, essentially, Dislocation, with a wound in the skin communicating; thus exposing the injured joint, however indirectly, to the action of the air. The structural disorganization as regards the state of the joint, is the same as in simple dislocation; but compound dislocation is usually accompanied with more severe contusion or laceration of the surrounding soft textures. This condition, coupled with that of the aperture externally—which is also contused or lacerated; together form a Contused or Lacerated Wound, connected with, and around, a Dislocation.

The *Signs* of this injury are the same as those of simple dislocation, with the additional and distinctive character of an external irregular wound. In short, both the condition and characters are those of simple Dislocation, *plus* those of contused or lacerated Wound.

Compound dislocation occurs most frequently in the ankle-joint; occasionally in the knee and elbow; rarely, in the shoulder; and very rarely, in the hip-joint.

*Causes, and Effects of Compound Dislocation.*—Here also, the pathological history is that of simple dislocation, with certain peculiarities superadded. Generally speaking, the dislocated bone, having passed through the adjoining soft parts, in the direction of the displacement, and come to the surface, it protrudes through the skin; and thus the wound is an extension of the injury from *within*. But, in some cases, external violence is the cause of the wound in the skin and subjacent soft parts, as well as of the connected dislocation; which may then be regarded as produced by an extension of the injury from *without*. In the one case, the force is applied indirectly, to the bone at some distance off, and the injury is more a laceration, and less extensive; in the other case, the force is applied directly to the joint, and the injury is more a contusion. In both cases, the lacerated or contused textures are damaged beyond the apparent extent of injury; and the shock to the nervous system is more severe than with simple dislocation, owing to the greater damage to the soft parts, including nerves.

Tetanus is, perhaps, more likely to occur than after a contused or lacerated wound alone, and especially if the compound dislocation



be that of a ginglymoid joint, as of the thumb. Injuries of unyielding fibrous or ligamentous textures are, generally, prone to induce Tetanus. [P. p. 442.]

The textures injured, being in a state of disintegration, die, at least to some extent around, if the wound be allowed to remain open. This purely *traumatic* gangrene is the same as that caused by a lacerated or contused wound. Limited, therefore, to the part injured, and defined, eventually, by a line of demarcation between the living and dead textures; the gangrene is also immediate, if the injury itself be severe.

*Course and Terminations.*—Inflammation supervenes, followed by suppuration, often profuse, and partial sloughing; or gangrene, possibly, on a larger scale. Yet this also is limited to the seat of injury. Ultimately, compound dislocation, when reduced, not unfrequently undergoes reparation; the torn ligaments and tendons becoming reconnected, and the wound closing up by the healing process of suppurative granulation and cicatrization.

*Spreading gangrene*—due to some morbid condition of the blood—is only contingent, occasionally, on compound dislocation; just as it may be associated with compound fracture, and with contused and lacerated wounds. The phenomena of this species of gangrene were described under the last-named form of Injury.

The *Prognosis* of Compound Dislocation, as gathered from the foregoing elements of its natural course and tendency, is far less favourable than that of simple Dislocation. An *open* wound, communicating with the joint, as compared with subcutaneous laceration of the soft parts, is one unfavourable ground of prognostic distinction. Scarcely less so, is the *greater extent* of their laceration, usually, in compound Dislocation, especially if produced by direct violence. [P. p. 724.] *Spreading gangrene* is an adventitious condition, but as implying the co-operation of a constitutional cause, it has a most unfavourable significance. [P. p. 737.]

*Treatment.*—The same rules of treatment are applicable as for simple dislocation; but, certain particulars, having reference to the special pathology of compound dislocation, are peculiar to its treatment.

*Reduction* of the displacement may present special difficulties. Thus, if the bone *protrude*—Excision is preferable to violent efforts at reduction. The head of the astragalus has been removed, when, by dislocation forwards, it protruded and could not be returned.

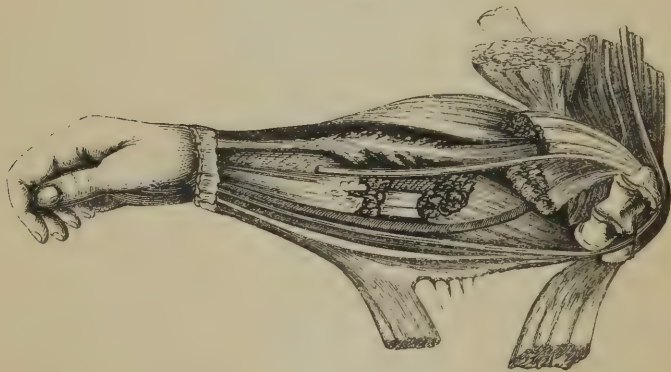
*The Wound.*—Reduction having been accomplished, and the limb retained in a suitable position—to prevent the recurrence of dislocation—by appropriate bandaging or apparatus; the treatment peculiar to *compound* dislocation is that relating to the wound, and state of the soft parts involved. The *primary* indication is to close the wound, with the view of soliciting its union by adhesion, and thus convert the dislocation into a simple one. For this purpose, a pad of lint—soaked in blood from the wound, as formerly practised, or better, simply wet lint, or soaked in carbolic acid solution, should be applied over and around the wound—so as entirely to exclude the air. But—subsequently—watching the progress of the case; when primary adhesion becomes obviously impossible, the attempt should be forthwith discontinued, in order to give free vent to matter, during the process of suppuration. *Early* solicitation of healing by primary adhesion, and *timely* abandonment of the attempt, in favour of suppuration, as soon as this event occurs, or is inevitable;

constitutes a compromise, which overrules any objection as to the *probable* failure of the one, and the supervention of the other. It may secure the advantage, otherwise forfeited, of then having to deal with only a *simple* Dislocation.

In the event of Suppuration ; early, free, and dependent *incisions* are indicated, for the same reasons, as in compound fracture ; and a poultice, or spongio-piline soaked in warm water as a fomentation, is now the appropriate application ; to be exchanged for light water-dressing, or with carbolic acid solution, when the continuance of warmth with moisture would only sodden and relax, and when the wound is granulating. The same *hygienic* and *medical* treatment also, as for compound fracture, will prove efficacious in sustaining the system under the *hectic fever* and exhaustion consequent on prolonged and perchance profuse suppurative discharge, and in overcoming the typhoidal fever induced by gangrene or sloughing.

*Amputation*.—The “question of amputation,” depending upon the supervention of either profuse suppuration or gangrene ; the *propriety* of this operation is determined by pathologico-anatomical conditions parallel to those of compound fracture. (1) *Primary* amputation, only when the

FIG. 161.



whole substance of a limb being involved by compound dislocation, the limb itself is already, in the first instance, virtually lost, and life as inevitably endangered. Such was the condition of compound dislocation, represented in (Fig. 161), the integuments having been removed from the limb to display the various kinds and extent of lesion. Unique, as a new form of elbow-joint dislocation, by dislodgment of the radius and ulna outwards and *upwards* on to the external ridge of the humerus above the condyle, the forearm had thus undergone an “external latero-angular dislocation.” The relative position of the bones, and thence the peculiar appearance of the joint externally and configuration of the limb, are more particularly described in the Brit. and For. Med. Chir. Rev., January, 1866. As justifying amputation—the lesions *co-existing* were these. A large lacerated wound about the middle of the forearm in front, exposing the muscles and a portion of both bones, with the interosseous membrane. All the flexor muscles, superficial and

deep, were torn across, partially or entirely, sparing their tendinous and aponeurotic portions, which appeared deep in the wound as so many shreddy strings from which the muscular substance had been raked off. All the vessels and nerves, however, excepting, of course, their muscular branches, had escaped rupture; the ulnar nerve, the inferior profunda artery accompanying it above the joint, and the ulnar artery in the forearm, the median nerve with its interosseous branch and the corresponding branch of artery, and lastly, the radial artery and nerve. But the skin was almost completely detached from the sheath of the muscles on the front and back of the forearm, and some way above the joint. The large tract of subcutaneous cellular texture thus disorganized was infiltrated with blood, not discernible through the skin, which appeared unbruised. A small contused aperture just above and behind the inner condyle communicated directly with the joint, constituting a compound dislocation. This extensive injury was caused by severe contusion and a lacerating wrench between the buffers of two railway carriages. (2) *Secondary* amputation, when the extent of damage done by the injury being itself partial, the supervention of profuse suppuration or gangrene is only proportionately probable; and the limb, therefore, not inevitably lost, nor the life perilled. Such postponement of amputation is justifiable to give the limb its chance of preservation by delay; while the preservation of life is provided for by timely amputation, when the adverse circumstances, alluded to, actually supervene.

The rules laid down in surgical works, with reference to the *extent* of injury, are not the expressions of a sufficiently accumulated pathological experience, in different doubtful cases; and they overlook the necessarily unknown capabilities of reparation in different individuals. Cases occurring, from time to time, which have proved exceptional to any such rules, suggest the all-important consideration; in how many more cases might limbs be saved which are thus sacrificed surgically?

No extent of injury, as to the vessels, nerves, muscles, and integuments—short of the whole substance of a limb being involved—in connexion with compound dislocation, can be said to absolutely prohibit the attempt to preserve the limb, in the first instance.

Thus, compound dislocation of the knee-joint, was pronounced by Sir A. Cooper to be a condition of disorganization which imperatively demanded primary amputation. Exceptions, occasionally, have since disproved that dictum, in this form of injury. In the case of a boy, nine years of age, at the Westminster Hospital, Mr. White succeeded in saving the limb, by sawing off the condyles of the femur and reducing the bone. In the ankle-joint the end of the tibia may be removed and reduction accomplished; a proceeding which I remember Mr. Liston advocated nearly a quarter of a century ago. A person jumps out of a carriage behind, while the horse is running away, and alighting on his feet, the tibia of either leg may be driven through the integuments and, perhaps, come in contact with the earth. Removal of the bruised portion of bone, will facilitate the reduction, and has proved successful in preserving the limb. Dislocation of the astragalus, in like manner, may be similarly treated. *Excision*, indeed, bids fair to surpass amputation in other compound Dislocations.

COMPLICATED DISLOCATION.—Dislocation may be complicated by association with the laceration of *muscles* which are put upon the stretch; as



the pectineus and adductor brevis, by dislocation of the thigh downwards into the thyroid foramen; even their unyielding *tendons* are sometimes ruptured, as the sub-scapularis tendon, by dislocation into the axilla. *Large blood-vessels* occasionally share the same fate, accompanied with hæmorrhage and livid swelling; a *main nerve* also may be torn asunder. *Fracture* of the shaft or of the head, of the bone dislocated, is another complication. This is more likely to occur in dislocation from direct violence; as by a fall on the hip or shoulder, the neck of either bone is perilled; the olecranon also may be knocked off; the bulky head of the tibia shattered; or the tarsal end of the tibia broken and bruised. Thus, then, all the parts *around* a dislocation are liable to be involved in the injury. But, obviously, none of those special injuries to internal organs can occur, which may complicate the Fracture of certain bones. Respecting *morbid conditions*; local diseases—*i.e.*, of the joints themselves, may predispose to dislocation and thence to its recurrence, by previous disorganization of the joint affected; a parallel kind of complication to that of fracture from disease of the bone. So also, the diseased condition of the joint is frequently a local *manifestation* of some blood-disease—*e.g.*, syphilis or scrofula, as a constitutional cause, rather than of traumatic or local origin. Whenever dislocation from disease of the joint has the former mode of origin, the reparative process is proportionately slow and uncertain; the more so when the constitutional disease is actually in operation.

Of all these complications of Dislocation; those which are combinations of other forms of *injury* therewith, have been *already* noticed in connexion with compound Dislocation; while predisposing diseases of the joints, will be taken in relation to Unreduced Dislocation.

*Treatment*.—Both the general considerations of pathology, and the corresponding Rules of Treatment, pertaining to Complicated Fracture, are applicable also to Complicated Dislocation.

1stly. If any *morbid condition* be in operation, locally or constitutionally, the treatment must be entirely *subject* to such *causative* condition, as connected with the Dislocation. 2ndly. If there be any *injury additional* to Dislocation; the treatment of the *dislocation* may be of entirely subordinate importance, even although it be, as in many such cases, severely compound.

UNREDUCED DISLOCATION and FALSE-JOINT; CONGENITAL DISLOCATION.—These pathological conditions may be taken consecutively; the one as the result of neglected or possibly, irreducible Dislocation, the other, as being irreducible or incapable of continued reduction, owing to some congenital malformation. Both are supplementary to the pathology and treatment of ordinary Dislocation.

UNREDUCED DISLOCATION, and FALSE-JOINT.—*Structural Condition*.—The alterations of structure consequent on unreduced Dislocation are, the formation of a new joint, the obliteration of the former or natural articulation, and of the track through which the head of the dislocated bone passed to its present locality.

The new *joint* is more, or less, perfectly constructed. If the displaced bone be lodged upon *muscle*; it gradually burrows for itself a convenient nest, the two surfaces become mutually adapted to each other, and a capsular ligament being formed of condensed cellular tissue, an imperfect joint is established. But should the bone have found a resting-place on *bone*, this, by absorption, loses its periosteum, and that, its articular cartilage; a receptacle is excavated suitable to the impression of the dis-

placed articular surface; a bony rim or lip is thrown up by the periosteum around the margin of this newly formed cavity, the surrounding cellular texture, moreover, becomes condensed into a capsular ligament, which further provides against any displacement; and thus a far more perfect joint is constructed. (Fig. 162.)

FIG. 162.



A porcellanous deposit takes the place of cartilage, on the head or surface of the dislocated bone; or instead of this "*eburnation*," an imperfect fibro-serous surface or synovial capsule may be formed. (Hamilton.) The *natural articular cavity*—whence the bone was dislodged—loses its cartilaginous investment, and closes in. It is, at length, partially obliterated by a dense fibrous deposit. (See Fig.) So also is the *track* in the textures, through which the bone had passed.

Associated with this articular transformation, are certain accessory, but somewhat accidental changes, in relation to the ligaments, muscles, and tendons.

The *ligaments* perhaps become firmly adherent to the neck of the bone, thus further opposing its reduction, and if the rent be small through which the bone escaped, it may be tightly embraced. This is more apt to occur in a capsular ligament. Other ligamentous conditions are peculiar. The orbicular ligament around the neck of the radius may have been carried away entirely by dislocation of this bone, and be firmly attached at both ends to the humerus. A specimen of this kind is preserved in the museum of St. George's Hospital. The *muscles* which act on the displaced bone become permanently shortened, while their lines of action get accommodated to the displacement, and help to retain the bone in its new position. Or if any tendons were partially or entirely torn across by the violence of dislocation, they may have acquired new attachments, and such as are mechanically unadapted to the action of the muscles. A ruptured tendon sometimes forms a band of adhesion between the bones. In one instance,\* the tendon of the brachialis anticus muscle, having been torn off the coronoid process of the ulna, which was dislocated backwards into the olecranon fossa; this tendon became firmly united both to the

\* Specimen of dislocated elbow. Museum of St. George's Hospital. T. Holmes.

trochlear surface of the humerus and to the ulna below its original attachment, forming a kind of soft ankylosis between them. A tendon thus attached, is unfavourable to the action of the muscle connected therewith, yet its attachment aids in rendering the dislocation irreducible. Bony nodules form, occasionally, in the tendons around the seat of dislocation. Lastly, in these general changes, should be noticed the important one of adhesion sometimes having taken place between a large artery and the capsule or periosteum of the displaced bone.\*

All these structural alterations take place very slowly. The destructive changes, implying an irreparable sacrifice of the articular cavity, Nature reluctantly obliterates it, and with it the opportunity for reduction; only when long disappointed by delay and wearied by the lapse of time. The reparative alterations—those pertaining to the formation of a new joint—are most complete in ball-and-socket dislocations, as the hip-joint; the compensatory substitute for any hinge-joint is far less complete. In some such instances even, bony ankylosis is the result.

The *Diagnostic Signs* of unreduced Dislocation, and of the construction of a new joint, are; the physical signs of dislocation, *coupled* with restoration, more or less entirely, of the functional use of the limb or part. The characteristic alterations, in the form of the joint, length of the limb, and direction of its axis, still remain; while the power of using it is regained, and proportionately as the new articulation is perfectly finished off. Hence, this restoration of function is, at length, far more thoroughly established in unreduced Dislocation of a ball-and-socket joint, than in that of a hinge-joint.

*Treatment.*—The question of *interference* should be determined by the *mobility* of the new joint. (a) When freely moveable, the natural articular cavity or surface is probably obliterated; the processes of construction and destruction having proceeded simultaneously and correlatively. Hence, the indication is, *not* to interfere, to leave such an unreduced dislocation alone; any attempt at reduction being useless or worse. Under these circumstances, reduction has, indeed, been effected, but with great injury to the limb, and even with a fatal result. In one such case, that of a dislocated shoulder, reduction was followed by great swelling of the arm, a tumour formed in the axilla, which, at the end of thirty-eight days, burst with alarming hæmorrhage. Ligature of the subclavian artery fortunately saved the patient's life.† In other cases, suppuration in and around the joint, and gangrene of the limb, have been known to occur.‡ (b) When the action of a new joint is less easy, and less efficient; reduction of the dislocation may be *attempted*, and with successful issue to limb and life.

The *kind* and *amount* of extension, are, however, features in the treatment, worthy of special attention. Extension, gradually increased, and continued for perhaps some hours, or renewed daily, is necessary; to overcome the resistance of the shortened muscles, any adhesions of the tendons or ligaments, and to extricate the bone from its new articular adaptations. But, it should ever be remembered that, possibly, more than these *mechanical* obstacles to reduction, exist. There is always some risk of rupturing any blood-vessels which may have become adherent. Yet this is an accident which cannot be foreseen, otherwise than

\* Op. cit., Hamilton, 1860, p. 492. † Med.-Chir. Trans., 1846, vol. xxix. p. 25.

‡ *Traité des Fractures, etc.*, Malgaigne, vol. ii. p. 143.



by observing the general rule laid down respecting any surgical interference. Of course, reduction should be conducted under the influence of chloroform.

The *extreme periods* of unreduced Dislocation, within which limits reduction is practicable, with safety to the limb and life of the patient; can scarcely be determined by experience. Nor is this question of much practical importance, considering the functional conditions, already mentioned, which should guide the Surgeon. Successful results have been obtained at extreme periods, varying from a few days to many months, and even beyond two years! In a dislocation of the *elbow*, backwards, unreduced for six months, Mr. Darke\* continued extension with pulleys during eight hours and a half, when the bones returned to their proper situation. Three other cases of this date were successful in the hands of Gorre and Gerdy.† A dislocation of the *shoulder*, unreduced for six weeks, was overcome by Mr. Mash,‡ in the Northampton Infirmary, by extension at intervals with *pulleys*, during eight hours. A dislocation of the head of the *radius* forwards, of twenty-five months, in a child nine years old, was reduced by Dr. Stark;§ extension being repeated daily for twenty-two days, consecutively.

This is, I believe, the longest period at which such extension has been successful, in unreduced dislocation of *any* joint in the upper extremity. *Manual* extension has proved sufficient in some cases. Thus, I reduced a dislocation of the *radius backwards*, of ten weeks; the adhesions about the head of the bone audibly giving way. In the lower extremity, the periods of limitation have been much less, with regard to the *hip-joint*. In two instances, dislocation of the femur on the *dorsum ilii*, has been reduced after the lapse of six months. In both, reduction was effected by "manipulation;" the one,|| under the influence of chloroform, the other,¶ without; but in this case the patient, a boy, was feeble and the muscles flaccid. In both, the results were successful; the limb recovering its functions and the muscles regaining their bulk and strength. Respecting the *hip- and shoulder-joints*; Sir A. Cooper's large experience led him to select two months in the one case, and three months in the other, as the extreme periods at which reduction can be *safely* accomplished.

Any *opposing* tendons, ligaments, or adhesions, suggest the propriety of a previous accessory operation; that of dividing them, subcutaneously. Simple as this may appear, it is not always practicable, with a fair degree of safety to the part, and even to the life of the patient. Yet there are successful results on record. Thus, in dislocation of the thumb backwards upon the metacarpal bone, reduction may be impossible, unless by subcutaneous division of the lateral ligaments. Sir Charles Bell first proposed the operation in this case, and it has since been successfully practised by Liston, Reinhardt, Gibson of Philadelphia, Parker of New York, and other Surgeons. Lizars and Syme advocate this practice in certain instances. An unreduced dislocation of the shoulder-joint, of two years' duration, was overcome by Dieffenbach, in like manner. In one instance also, an old dislocation of the elbow, which still resisted after

\* Prov. Med. Journ., Dec., 1842, p. 250.

† Mém. sur les luxations du coude. P. Denucé, 1854, p. 86.

‡ Lancet, Sept., 1844.

§ Edin. Med. and Surg. Journ., 1848, vol. ix. p. 77.

|| By Dr. Blackman, Ohio Med. and Surg. Journ., vol. viii. p. 522.

¶ Fractures and Dislocations, Hamilton, 1840, p. 663, Philadelphia.

division of the tendons and ligaments, was reduced by dividing the adhesions. M. Blumhardt\* made a longitudinal incision on either side of the joint, laid open the capsule, freely divided the adhesions, and replaced the bones. The limb is said to have recovered its natural mobility, and the patient resumed his occupation as a carpenter.

In cases such as these, the *periods* after dislocation, at which operations have proved successful, are comparatively unimportant; for the difficulties of reduction being thus overcome, the operation *itself* is the only important consideration—*i.e.*, as to its propriety and practicability.

CONGENITAL DISLOCATIONS.—The whole pathology of “Dislocations existing at birth,” requires further investigation, in respect to their structural conditions, causes, and vital history.

Congenital Dislocations are, apparently, of three kinds: (*a*) Physiological dislocations; or those resulting from an original defect in the germ, or from an arrest of development. (*b*) Pathological dislocations; or those resulting from some lesion of the nervous centres, from contraction or paralysis of the muscles, laxity of the ligaments, hydrarthrosis, or some other diseased condition of the articulation. (*c*) Mechanical dislocations; or those resulting from some peculiar position of the fœtus in utero, violent contractions or constant pressure of the walls of the uterus, falls and blows upon the abdomen, and unskilful manipulation of the child in delivery. These might be termed traumatic dislocations. Probably all the joints are liable to congenital Dislocation, in some form or forms; and with regard to most of the joints, this kind of lesion has already been established by dissection. Hamilton has collected many such instances; but it appears to occur most frequently in the hip and shoulder-joints.

The *Treatment* of Congenital Dislocation is *generally impracticable*. What to do may be obvious; the removal of any one, or more, of the known conditions which originally produced the dislocation; but how to do this successfully, may be impracticable, owing to those conditions being, generally, defective forms of structure, which, in producing, also perpetuate the recurrence of dislocation. Persistency of the cause, or causes, in operation, thus renders these lesions mostly incurable.

The fact of congenital dislocation of the *hip* occurring, was known to Hippocrates, and expressly noticed in his work, “*De Articulis*.” Other early authors, Avicenna, Paré, and Kerkring, also mention such dislocation of this joint; the latter recording an example verified by dissection. Subsequently, Chaussier† recorded a congenital dislocation of the *shoulder*, and another of the *hip*, both in the same infant. Paletta, of Milan, added to the cases then known;‡ and, in his hands, the injury first assumed a pathological character.§ But it was reserved for Dupuytren|| to investigate congenital dislocations, enlightened by pathology and physiology. Among other special authorities, the following have contributed the most valuable sources of information:—Breschet,¶ Caillard-Billionnière,\*\* Lehoux,†† Sandiforte,‡‡ Duval and Lafond, Humbert and

\* Gaz. Méd., 1847, p. 238.

† Bulletin de la Fac. et de la Soc. de Méd., 1811–12.

‡ Adversaria Chir., 1738.

§ Exercitationes Path., 1820.

|| Leçons Orales. Trans. by Syd. Soc.

¶ Répertoire d'Anat. et de Physiologie.

\*\* Thèse Inaugurale, 1828.

†† Thèse Inaugurale, 1834.

‡‡ Thesis—before Fac. of Med., Leyden.

Jacquier, Bouvier,\* Sédillot,† Gerdy, Polinière, Vrolik,‡ Guérin,§  
 Parise,|| Pravaz,¶ Carnochan,\*\* R. Smith,†† and last, not least,  
 Malgaigne.‡‡

## CHAPTER XXXIII.

### SPECIAL DISLOCATIONS.

DISLOCATIONS OF THE LOWER JAW.—*Structural conditions.*—Complete dislocation on *both* sides consists in the dislodgment of both condyles from the glenoid fossæ, and their displacement forwards, in front of the anterior or transverse root of the zygoma, on either side; the coronoid processes thus being brought forward, and corresponding to the under aspect of the malar bone, on either side. (Fig. 163.) Similar dislocation on *one* side only, represents the same altered articular relations of the condyle, on that side; with a twist of the jaw to the opposite side. *Partial* dislocation, or subluxation of the jaw, is, apparently, a displacement in relation to the inter-articular cartilages; the condyles slipping forwards in front of these cartilages, on both sides, or on either side alone. Bilateral dislocation occurs in about two of every three cases. Partial dislocation happens, comparatively, seldom.

FIG. 163.



*Signs.*—Certain obvious and characteristic signs attend dislocation of the jaw. The mouth is open, the jaw being drawn down by the action of the genio-hyoid muscles, and the lower teeth project in front of the line of the upper teeth. This open-mouthed appearance is more conspicuous at first, the distance between the teeth extending sometimes to an inch and a half; subsequently the jaws become more closed, but the coronoid processes, hitching against the malar bones, mechanically oppose any nearer approximation. Deglutition and speech are interrupted, the lips moving when the person attempts to speak and the saliva dribbling

\* Duval and Lafond, Humbert and Jacquier, Bouvier.—See Pravaz.

† Journ. de Connais. Med.-Chir., 1838.

‡ Gerdy, Polinière, Vrolik.—See Pravaz.

§ Recher. sur les Lux. Congen. 1841.

|| Archiv. Gen. de Méd., 1842.

¶ Traité Théorique et Pratique des Lux. Congen. du Fémur; suivi d'un Append. sur la Prophylaxie des Lux. Spontanées, 1847. Lyon.

\*\* Etiology, Pathology, and Treatment of Cong. Dis. of Head of Femur, 1850. New York.

†† Fractures in Vicinity of Joints, and on certain Accidental and Cong. Dislocations, 1854. Dublin.

‡‡ Traité des Fractures et des Luxations. 1855.



over the chin. The cheeks are stretched and flattened, and the angles of the jaw directed somewhat backward towards the mastoid process of the temporal bone, on either side; a depression can be felt in front of the external auditory meatus, corresponding to the natural situation of

FIG. 164.



the condyle, and an oblong prominence in the temporal fossa with fulness of the masseter muscle. (Fig. 164.) Dislocation on *one* side only is denoted by the same signs; but in a lesser degree, and one-sided, the jaw being twisted somewhat to the opposite side, though this alteration may be scarcely appreciable. A depression can always be felt in the proper situation of the condyle, and not on the other side.

Partial dislocation presents similar signs, but they are still less perceptible, and perhaps recurring, the condyle slipping to and fro.

*Causes.* — *Muscular action* would seem to be the usual cause, in the act of opening the mouth widely; as in laughing, gaping, violent declamation, yawning, or an attempt to take too large a bite.

The condyles moving forward on the transverse root of the zygoma on either side, are dislocated by the action of the external pterygoid muscles; the genio-hyoid muscles then depressing the jaw. *External violence* is an occasional cause, as in tooth-extraction, or the forcible introduction of something into the mouth. Sir A. Cooper records such a case; two boys were struggling for an apple, and the one in attempting to thrust it into his own mouth, dislocated his jaw. *Age* would certainly seem to have some predisposing influence; complete dislocation occurring very rarely in infancy or advanced life, owing probably to peculiarities in the form of the jaw at these periods. Nélaton attributes its greater frequency in middle life, to the length and anterior inclination of the coronoid process. *Women* also seem more liable than men; and to partial dislocation in particular, which arises probably from relaxation of the ligaments of the jaw.

*Unreduced* dislocation of the jaw undergoes changes, whereby the jaw becomes approximated to the upper and its anterior projection is diminished, some mobility and power of movement also are regained; thus restoring mastication, deglutition and speech so far, that the person at length experiences no great inconvenience from the displacement.

*Treatment.*—Reduction is readily accomplished by retracing the displacement. The Surgeon standing in front of his patient, introduces his thumbs—protected by a cloth—into the mouth, and applies them to the lower molar teeth on either side; depressing the angles of the jaw, the chin is raised by the fingers externally at the same time, and the jaw is jerked in or returns with a snap. Dislocation on one side is reduced in like manner; and so also partial dislocation, which may, however, be

returned by the natural efforts to open and shut the mouth, the patient being told at the same time—as suggested by Professor Pirrie—to bring the jaw forward. A four-tailed bandage must then be applied, as in fracture of the lower jaw; and the patient fed on liquid food for some days, during reparation of the ligaments. After partial dislocation, the prevention of its recurrence may be aided by tonic treatment, and stimulant applications over the articulation.

Reduction has been effected after periods varying from days to several weeks; after one month and five days, by Sir A. Cooper, in a case of double dislocation; and after ninety-eight days, Donovan succeeded, in another case.

*Congenital Dislocation of the Lower Jaw*—denied by Malgaigne, but affirmed by Guérin, R. W. Smith, and Hamilton; is, however, very rare. In Dr. Smith's complete account of one such case; dissection showed an arrest of development of the dislocated side of the face; the osseous and muscular structures being atrophied and imperfect. A singular deformity of the face was thus occasioned, on the one side as compared with the other; and the usual signs of dislocation were absent or reversed,—the front teeth of the upper jaw projected beyond those of the lower, the mouth was closed or opened voluntarily, and these movements of the jaw were more extensive than in the normal condition.

This congenital dislocation is incurable.

DISLOCATIONS OF THE SPINE are almost necessarily accompanied with fracture of the articular processes, and of the bodies of the vertebræ; excepting in the cervical region, the articular processes there being placed more obliquely than those of the other vertebræ. Any dislocation of the spine is rare, and more so without fracture. Separation of the *inter-vertebral substance*, and displacement of the bodies of the vertebræ, may also occur. I have seen one such case, as shown by post-mortem examination.

The *Signs* and *Symptoms* of spinal dislocation are similar to those of fracture in this region; some irregularity or projection at the seat of dislocation, and paralysis, more or less complete, of those portions of the body which receive the nervous supply from below the point at which the dislocation has occurred. The diagnosis, as compared with fracture, can hardly be determined by crepitus, which may be absent in fracture, and present in all the dislocations accompanied with fracture; but, a peculiar rigidity of the spine in the position assumed by dislocation—the trunk inclining immovably forwards, backwards, or more commonly to one side, will generally be diagnostic.

*Causes*.—The same as in fracture; falls on the head, feet, or back, and violent flexions of the spine backwards, or to either side.

*Termination*.—Dislocations of the spine are, obviously, of a serious or fatal character; and—like fracture—more so, the higher in the spinal column dislocation occurs.

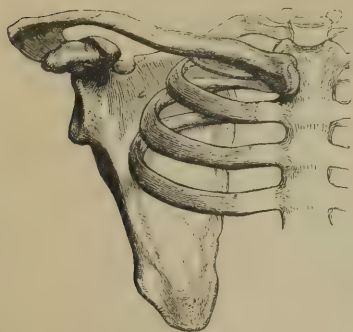
*Treatment*.—Reduction of the displacement is impossible, or would be perilous; and but little can be done beyond the general treatment for fracture of the spine.

DISLOCATIONS OF THE CLAVICLE.—(1) *The sternal end of the Clavicle* may be dislocated; *forwards*, in front of the sternum; *backwards*, behind the sternum; and *upwards*, or upwards and inwards, above the sternum. In these dislocations, the ligaments are more or less completely torn, ac-

cording to the direction and extent of the displacement; but the bone carries with it the clavicular portion of the sterno-mastoid muscle.

*Signs.*—Dislocation *forwards* is denoted by a deformity, consisting of the sternal end of the clavicle in front of the sternum (Fig. 165), which disappears by drawing the shoulders backwards and returns when such force is removed; the distance between the acromion and middle line is diminished; the head is drawn forwards and turned from the dislocation, in order to relax the sterno-mastoid muscle; and there is inability to raise the upper extremity.

FIG. 165.



Dislocation *backwards* is denoted by the opposite appearance to the former one, a depression in the situation of the sternal end of the clavicle; but there may be dyspnœa, dysphagia, obstructed circulation and pain; from pressure on the trachea, œsophagus, vessels and nerves, respectively. Several cases are recorded in the "London and Edinburgh Journal of Medical Science," October, 1841. Dislocation *upwards* is of rare occurrence; four cases only having been collected by Malgaigne, and a fifth, an extraordinary case, by Hamilton, as described

by Dr. Rochester in the "Buffalo Medical Journal." This form of dislocation presents a projection above the sternum—or in the remarkable case alluded to, upon the front of the thyroid cartilage—the sternal end of the clavicle having been thrown upwards; and there is also a corresponding depression of the shoulder.

*Causes.*—A fall on the shoulder, anteriorly, or throwing the shoulder backwards, may cause the dislocation forwards; compression of the shoulders, laterally, or a direct blow on the sternal end of the clavicle, may drive this portion of the bone backwards; and a fall on the shoulder externally, or a blow upon the top of the shoulder, may start the bone upwards, upon the supra-sternal notch. In one case, this dislocation was occasioned by direct violence, a bolt thrust up from under the clavicle.

*Treatment.*—Reduction of these three dislocations is accomplished by directing the shoulder so as to retrace the particular displacement. *Forward* dislocation of the sternal end of the clavicle may thus be overcome, by drawing the shoulder backwards and outwards; in *backward* dislocation, similar traction of the shoulder, to even a greater extent, will be efficient; while *upward* dislocation may be reduced by outward traction of the shoulder, at the same time raising the outer and depressing the inner end of the clavicle. Pressure directly on the displaced end of bone, when accessible, as in the first and last named dislocations, has comparatively little effect in aiding reduction. Traction of the shoulder is best effected by using the knee as a fulcrum in the back, while an assistant places his fist as a fulcrum in the axilla; the shoulders are then bent backwards, and the elbow brought down to the side, simultaneously.

To retain the bone in position; a pad over the sternal end may have some effect in dislocation *forwards*; but a figure-of-8 bandage applied to the shoulders will more effectually prevent the recurrence of displace-



ment in *either* of the *three* directions of dislocation, the arm being drawn back and fixed to the side. Some permanent displacement and deformity are almost inevitable; the patient, however, recovering a good use of the arm.

*Compound* dislocation occurred in one instance of dislocation backwards, by direct violence. (Hamilton.)

(2) *The scapular ends of the Clavicle* may be dislocated; *upwards*, upon the upper surface of the acromion (Fig. 166); or *downwards*, under the acromion, or under the coracoid process. The first-named dislocation is the most frequent, and indeed the most common of all dislocations of the clavicle; the second very rare, only 3 cases having been recorded of dislocation under the acromion, and 6, under the coracoid process. The acromio-clavicular ligaments are torn in the dislocation upwards; and, also, the coraco-clavicular and coraco-acromial ligaments in dislocation downwards.

*Signs.*—Dislocation *upwards* is easily recognised by the projection of the outer or scapular end of the clavicle, and which is more easily felt on tracing the spine of the scapula up to the acromio-clavicular articulation. Some depression and flatness of the shoulder will also be perceptible. Dislocation *downwards* is recognised, and distinguished, by the opposite signs; a marked depression, in particular, corresponding to the usual situation of the outer end of the clavicle. Downward dislocation, under the *coracoid* process, is more particularly characterized by a corresponding projection of the acromion and coracoid process, and a rapid inclination downwards and outwards of the line of the clavicle, its outer end being felt in the axilla. Inability to raise the arm to a right angle with the body, will generally be found symptomatic of either form of dislocation; but the arm can be moved, passively, in certain directions. Thus, the range of motion is most free in the upward dislocation; whereas, in downward dislocation, under the acromion, the arm can be moved pretty freely backwards and forwards, but not outwards; and, with dislocation under the coracoid process, the arm cannot be moved inwards and upwards. Pain accompanies any opposed motion of the arm.

*Causes.*—A fall on the shoulder would seem to be the usual, or only, occasion of these dislocations; the force being applied upon the top of the clavicle, to produce dislocation downwards. Thus, in one instance, a horse trod upon the shoulder; and in another, the accident occurred to a child, from an attempt to support a great weight upon the top of the collarbone.

*Treatment.*—Reduction is easily accomplished by drawing the shoulders backwards and forwards, the Surgeon placing his knee between them, as recommended by Sir A. Cooper. Considerable difficulty will, however, be experienced in preventing the recurrence of displacement. A pad in

FIG. 166.



the axilla, and the application of a bandage, as for fractured clavicle; constitute the most effectual retentive apparatus. Direct compression is available only in dislocation upwards. Many weeks should be allowed to elapse before this treatment is discontinued. Some deformity almost always remains, but with little loss of power in the movements of the arm.

*Dislocation of Both Ends of the Clavicle* has been known to occur, simultaneously; but it must be placed among the rarities of Dislocations.

**DISLOCATION OF THE SCAPULA.**—The *lower angle* of the scapula sometimes projects, apparently having slipped from under the edge of the latissimus dorsi muscle, which there crosses the scapula. I have seen one such case, on the right side.

Any treatment is unsatisfactory, as the bone easily starts out of place again.

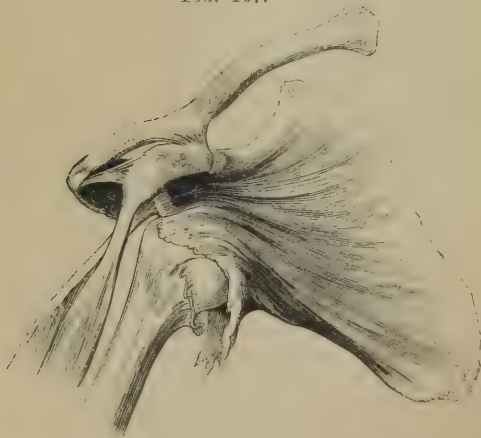
**DISLOCATIONS OF THE SHOULDER-JOINT.**—These are the commonest of all Dislocations. The head of the humerus may undergo dislocation; downwards, into the axilla, *subglenoid*; forwards, *subcoracoid* and *subclavicular*; backwards, on the dorsum of the scapula beneath its spine, *subspinous*. These dislocations occur in the same order of relative frequency; the first-named being by far the most common; the second, occasional; and the third, very rare. Subcoracoid dislocation has recently been regarded as the most frequent; Mr. Flower's investigations showing that of 41 specimens in the Museums of the London Hospitals, 31 are subcoracoid; and that in 50 cases known to him, 44 were of this form.

*Partial* dislocation is said to occur; either as the subcoracoid, or a dislocation upwards, under the acromion. But the former dislocation is complete, the head of the humerus being lodged entirely out of the glenoid cavity, in the illustrative case given by Sir A. Cooper; the upward dislocation is incomplete, the head of the bone lying partly in the glenoid cavity. Two such cases only are recorded, as having been verified by dissection; one by Mr. John Soden, jun., of Bath, in the "Medico-

Chirurgical Transactions," 1841; the other was taken from a subject brought to one of the dissecting rooms in Aberdeen.

**Structural Conditions.**—(1) Dislocation *downwards*, or *subglenoid*;—the head of the humerus is lodged in the axilla, just below the glenoid cavity, and resting on the inferior costa of the scapula (see Fig. 155), between the subscapular muscle and the long head of the triceps. (Fig. 167.) The

FIG. 167.



capsular ligament is torn to a considerable extent, and, generally, the tendon

of the subscapular muscle near its insertion into the small tuberosity. The muscles attached to the great tuberosity are stretched or torn, particularly the supra-spinatus; and, possibly, the tuberosity itself may be detached. The axillary vessels and plexus of nerves suffer compression by the head of the bone.

(2) Dislocation *forwards*, and *subclavicular*;—the head of the humerus lies under the pectoral muscles, on the inner side of the coracoid process, just below the clavicle (Fig. 168), and resting on the second and third ribs. The capsule may be completely separated from the neck of the bone; the lower scapular muscles much torn, namely, subscapularis detached from the smaller tuberosity, infra-spinatus and teres minor from the great tuberosity; and possibly, this prominence of bone may itself be torn away from the head of the humerus. The axillary vessels and nerves suffer compression.

FIG. 168.



(3) Dislocation *backwards*, or *subspinous*; the head of the humerus lies just behind the glenoid cavity on the dorsum of the scapula, below its spine (Fig. 169), and between the infra-spinatus and teres minor muscles. The capsule is ruptured, and the muscles in front of the joint are stretched or torn; namely, the subscapularis, supra-spinatus, and long head of the biceps.

FIG. 169.



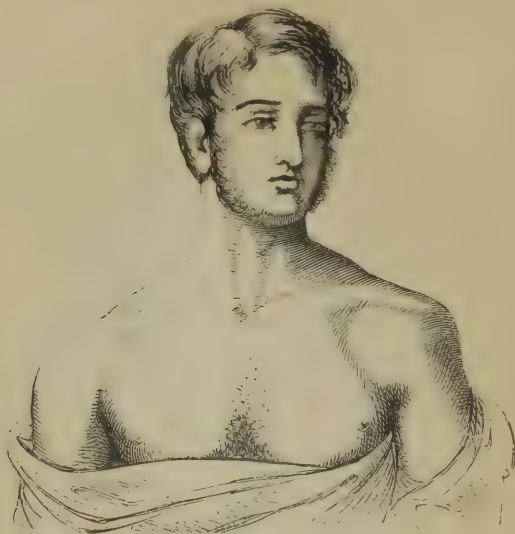
Partial dislocation *upwards* produces structural alterations, but less extensive. In both the cases already noticed, the head of the humerus was partly dislodged upwards, under the acromion; the capsule was slightly ruptured, and the long tendon of the biceps thrown out of its groove inwards, on to the smaller tuberosity of the humerus.

*Signs.*—Certain signs are common to all three, ordinary, dislocations of the shoulder. These signs are—flattening of the shoulder, externally; a depression below the acromion, owing to the absence of the head of the bone, and a corresponding projection of the acromion above (Fig. 170) (see Fig. 156); the presence of the head of the bone in an abnormal situation, downwards, forwards, or backwards; some immobility, and inability to use the arm, and pain, particularly when the arm is moved. But, the direction of the



axis of the humerus or arm, and the length of the arm, and the situation of the head of the bone, are distinctive in each form of dislocation: thereby determining its diagnosis.

FIG. 170.



Dislocation *downwards* into the axilla, is accompanied with some inclination of the arm *outwards*, in a line with the trunk, and neither backwards nor forwards; an elongation of the arm is observable, or can be ascertained by measurement,—taking the apex of the acromion as a fixed point above the joint, and the external condyle of the humerus below. The head of the humerus can be felt in the axilla.

Dislocation *forwards* or subclavicular, is distinguished by a direction of the arm *backwards*, and somewhat outwards; with some shortening. The head of the bone can be felt under the clavicle.

Dislocation *backwards* or subspinous, is characterized by a direction of the arm *forwards*, and somewhat outwards, or occasionally, it hangs by the side; with some shortening. The head of the bone can be felt under the spine of the scapula.

*Partial* dislocation upwards—in the case recorded by Mr. Soden—was characterized, principally, by the position of the head of the bone, which appeared to be drawn higher up in the glenoid cavity, and unnaturally prominent in front; abduction produced a sensation of crepitus, the humerus rubbing under the acromion, and becoming locked as the arm was raised; and severe pain was experienced by any action of the biceps muscle.

The *Diagnosis* of shoulder-joint dislocation as compared with *fractures* of the neck of the humerus, may be determined by the presence of the signs common to all these dislocations, and the absence of true crepitus. *Atrophy* of the deltoid muscle, resulting from contusion or other injury, simulates dislocation only by the flattening of the shoulder, and the overhanging acromion.

*Causes.*—*Direct* violence, as a fall on the shoulder, in the direction opposite to the particular form of dislocation. Thus, a fall from a height on the top of the shoulder may occasion dislocation downwards; and a fall on the front of the shoulder has been known to produce dislocation backwards, or collision of the front of the shoulder against a tree, in the case of a person thrown from a horse. *Indirect* violence applied to the arm when itself in a position favourable to the particular form of dislocation. Thus, forcible abduction of the arm may occasion dislocation downwards; and I have known it produced, as a recurring dislocation in an elderly gentleman, by merely resting the fingers on a chest of drawers, the arm being fully extended. Violent contraction of the deltoid in lifting a heavy weight, has also tilted the head of the bone downwards, out of the glenoid cavity. A fall on the elbow, the arm being directed backwards, may occasion dislocation forwards; and dislocation backwards has been produced by pushing a person violently, with the arm elevated. Spasmodic contraction of the muscles during an epileptic fit, was the cause of one such dislocation, in a case examined after death by Mr. Key.

The causative relation of shoulder-joint dislocations to each other, is worthy of notice. Dislocation forwards—subclavicular—may result as the completion of a subcoracoid displacement, which is then regarded as a *partial* dislocation forwards. Or, the subclavicular dislocation may, it is said, be consequent on dislocation downwards. Sir A. Cooper regarded the former as a primary dislocation; other eminent surgeons, for example, Desault, Petit, Dupuytren, Mr. Hey, and Professor Samuel Cooper, did not deny the possibility of its being primary; but they believed it to be very seldom so, and almost always secondary to dislocation downwards.

*Unreduced* dislocation of the shoulder-joint is followed by the slow formation of a new articulation, and destruction of the glenoid cavity; with proportionate recovery of the use of the arm. Thus, in an old dislocation downwards—described by Sir A. Cooper—the head of the bone had become flattened, and a new shallow cavity had formed for the reception of the head on the inferior costa of the scapula anteriorly, a complete capsular ligament also surrounding the head (see Fig. 157); while the glenoid cavity was entirely filled with ligamentous matter, in which were suspended small portions of bone, evidently of new formation, as no portion of the scapula or humerus was broken. *Reduced* dislocation is followed by good recovery of the use of the arm; some weakness only of the shoulder-joint remaining, with increased liability to dislocation. Aggravated by its recurrence, the looseness of articulation ultimately may be such that dislocation occurs on the slightest occasion of force in the right direction. In the case already alluded to of an elderly gentleman, dislocation downwards into the axilla had been overlooked by an Hospital Surgeon in attendance for three weeks; and, after reduction by Sir William Fergusson, it occurred four times in a period of eighteen months. Upward motion of the arm was afterwards restrained by wearing a belt around the chest, attached to an arm-loop, and the dislocation has not since returned.

*Treatment.*—Reduction may be effected in various ways:—

(1) By *direct* extension and counter-extension. This method is perhaps most generally applicable. The patient being seated in a chair, a sheet or jack-towel is drawn under the axilla on the dislocated side, around the chest over the opposite shoulder, and attached to some fixed, resisting object, or held by assistants. Extension is made from the arm

or wrist, by means of a linen band fastened by a clove-hitch knot. The arm should be drawn out at a right angle to the chest, and extension slowly maintained, by an assistant, or by pulleys, when necessary. (See Fig. 160.) The Surgeon placing his knee in the axilla, and depressing the shoulder with one hand, while he slightly inclines the arm downwards with the other; the head of the bone passes into the glenoid cavity with a jerk or snap, announcing the reduction. Extension is discontinued, and the arm brought to the side should be secured by a few turns of a

FIG. 171.



roller around the chest, supporting the elbow by a few turns below. An axillary pad may be advisable in dislocation downwards. Any inflammatory swelling about the joint will subside, or can be readily subdued by cold evaporating lotions. I have thus reduced nearly all the dislocations of the shoulder which have fallen to my lot. But the inconvenience of this method in private practice, is the assistance requisite, despite the relaxing influence of chloroform, and its administration would necessitate having another assistant.

(2) By the *knee in the axilla*, reduction can be effected without extension; simply by drawing the arm well down over the knee, as a fulcrum, depressing the shoulder, at the same time, with the other hand. This was one of the methods recommended by Sir A. Cooper. (Fig. 171.)

(3) By the *heel in the axilla*. The patient lying recumbent, the

FIG. 172.



Surgeon sitting on the edge of the couch, plants his foot well up into the



axilla, and drawing the limb well downwards, inclines it inwards across the foot as a fulcrum. This also was another method employed by Sir A. Cooper. (Fig. 172.)

(4) By *raising the arm*.—The patient lying recumbent, the Surgeon sitting behind the shoulder and fixing it with one hand, raises the arm up perpendicularly; then bringing it down suddenly to the side, the head of the bone may snap into place. (Fig. 173.)

FIG. 173.



(5) Dislocation *backwards* may sometimes be readily reduced by bending the arm backwards, and, at the same time, drawing forward the upper end of the humerus, with the other hand.

*Unreduced* dislocations of the humerus are to be overcome by one or other of these methods; generally, by direct extension and counter-extension, under the influence of chloroform; aided, perhaps, by pulleys for making extension, which should be slowly maintained. Dr. Jarvis's "adjuster" has proved effectual when other means have failed. Its principal advantage is that during extension, the limb can be moved about freely in all directions, without relaxing the extension.

The *periods* after dislocation when reduction has been accomplished, vary as to their extreme duration; a month, in one of my own cases; after twenty-five weeks, by Mr. Brodhurst; after seven months, and ten months and a half, by Mr. Smith, of the United States. Dieffenbach accomplished the reduction of a dislocation forwards after two years' duration; but not until he had cut the tendons of the pectoralis major, latissimus dorsi, teres major and minor, and had divided the ligaments surrounding the new joint.

The *extreme period* for the *safe* reduction of dislocation is probably best determined by observing the movements afforded by the new joint; and which indicate also the probable *utility*, or otherwise, of reduction, although itself practicable. *Accidents*, of a most serious character, are liable to happen in the reduction of old standing dislocations; laceration of the muscles and tendons, rupture of the axillary vessels and nerves, or fracture of the neck of the humerus. These lesions may occur apart from any inconsiderate application of extending force.

*Compound* dislocation of the shoulder-joint is a rare form of injury.

Erichsen mentions having seen two cases, and in two directions, of dislocation; inwards—sub-coracoid, and—downwards—sub-glenoid; to which may be added one more, into the axilla, as recorded by Hamilton among his own cases; and a compound dislocation of the shoulder by Sir A. Cooper.

*Treatment.*—Reduction was effected in both Mr. Erichsen's cases, and they did well. The question of *amputation* must be determined by reference to the considerations which render the sacrifice of the limb inevitable in COMPOUND DISLOCATION, generally; and principally, regarding the injury to the axillary vessels and nerves.

*Dislocation, with Fracture of the Humerus, its Neck or Shaft.* (See Fig. 107.) Some such cases are recorded by Hamilton.

Their *treatment* is the only peculiarity of practical importance; as to whether the dislocation, or the fracture, should be reduced first? The former manipulation can, generally, be accomplished without much difficulty. Extension will hardly avail much, or indeed be necessary, in effecting reduction of the dislocation. Pressure on the head of the bone, aided by the relaxing influence of chloroform, has proved quite sufficient. Failing in this way; the fracture may be reduced and put up firmly, thus allowing of extension, or one of the other methods for reduction of the dislocation. Failing still to reduce the dislocation, the fracture must be alone regarded; and then at the earliest period after union of the fragments, reduction of the dislocation should again be attempted. This latter was the rule of treatment at one time, and it led to many successful results. But, it implied that which experience has since disproved, the impossibility of reducing these complicated dislocations until the fracture had united.

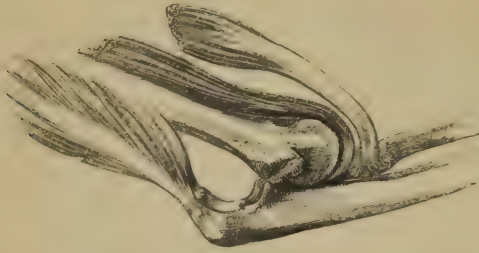
*Congenital Dislocations of the Shoulder-joint.*—Three varieties are recognised by Guérin; dislocation of the head of the humerus downwards; downwards and inwards, the head of the bone resting against the ribs; and subluxation upwards and outwards, the head of the bone sliding in this direction, favoured by a corresponding displacement of the coracoid and acromion processes. Dr. Robert Smith has met with only two forms of congenital dislocation of the humerus, sub-coracoid and sub-acromial; of the former he has seen several examples. These dislocations, arising from either a paralytic condition of the muscles, or from developmental imperfections of the articulation, are necessarily incurable.

DISLOCATIONS OF THE ELBOW.—This joint is liable to eight recognised dislocations; four of which relate to both bones; one to the ulna alone, and three to the radius alone. Thus (1) dislocation of both bones backwards; (2) outwards; (3) inwards; (4) forwards; (5) dislocation of the ulna alone, backwards; (6) dislocation of the radius alone, backwards; (7) forwards; (8) outwards. To these recognised dislocations may be added another; dislocation of both bones outwards, and upwards *laterally* on the humerus, constituting an "external latero-angular dislocation" of the elbow-joint, as I so named this form of dislocation, in the only instance I have ever seen or can find recorded. (See Fig. 161.)

*Structural Conditions.*—(1) Dislocation of the *radius and ulna backwards*, is the most frequent form. The head of the radius is lodged behind the external condyle, and the coronoid process of the ulna lies in the olecranon fossa; the lower end of the humerus resting on the anterior surface of the radius and ulna (Fig. 174). All the four ligaments are ruptured, leaving only some of the fibres of the internal lateral one. The

annular ligament remains entire. The brachialis anticus and biceps muscles are stretched or torn, the former sometimes carrying away a portion of the coronoid process; but the other muscles are relaxed, the triceps posteriorly, and all the muscles originating from either condyle of

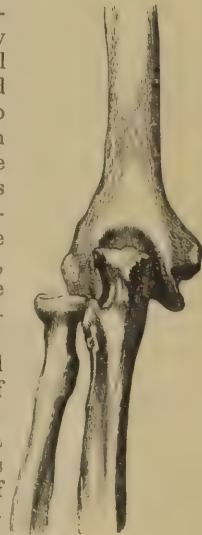
FIG. 174.



the humerus, excepting the supinator radii brevis. The median nerve is pressed forwards by the humerus; and the ulnar nerve is, sometimes, painfully stretched over the projecting extremity of the ulna backwards.

(2) Dislocation of the *radius and ulna outwards*, or to the radial side (Fig. 175), is far less frequent than the foregoing, and usually incomplete; complete dislocation having been known to occur in only 11 cases. *Incomplete* dislocation; the ulna still articulates with the humerus, but the great sigmoid cavity is carried outwards from the trochlea, so that its central crest rests upon the depression which separates the condyle from the trochlea. If the annular ligament remains unbroken, the radius is displaced in the same direction and to the same extent, its head resting against and directly below the outer condyle. More complete dislocation may occur, and complete dislocation, rarely; the head of the radius being perhaps, thrown forwards or backwards.

FIG. 175.



A *variety* of this dislocation, is outwards and upwards or backwards; the olecranon process of the ulna lying above and behind the outer condyle.

The *NEW variety*, to which I have alluded, is a complete dislocation of the radius and ulna outwards and upwards *laterally*; the large sigmoid cavity of the ulna embracing the outer condyle and capitellum, just behind its articular surface, at a right angle, externally, with the humerus; and the head of the radius above, being in close relation to the external ridge of the humerus, which (ridge) bisected its round cup-like cavity. The head of the radius, therefore, was neither wholly in front nor behind the humerus; it was not dislocated forwards or backwards.

In outward dislocations, the ligaments are more or less completely torn; but, in the ordinary forms of such dislocation, the brachialis anticus and anconæus are the only muscles much disturbed, the biceps and



triceps traversing the articulation a little more obliquely; while the principal arteries and nerves do not suffer much, if at all.

In the variety which I have described, the state of the muscles is also fully noticed with the arteries and nerves; of which the latter structures had singularly escaped injury.\*

FIG. 176.



(3) Dislocation of the *radius and ulna inwards*—or to the ulnar side—is much more rare than dislocation outwards, and always incomplete, no example of complete dislocation inwards having been recorded. The ulna is driven over the elevated inner ridge of the trochlea, and falls down on the inner condyle, or epi-trochlea, embracing it instead of the trochlea; while the head of the radius, passing inwards also, occupies the trochlea. (Fig. 176.) The head of the radius is, generally, in the same line with the ulna; but it may be found a little forwards or backwards.

A variety of this dislocation, is inwards and upwards or backwards; the coronoid process of the ulna being thrust upwards above the inner condyle, and the head of the radius occupying the olecranon fossa.

The ligaments and muscles suffer some injury, and the ulnar nerve is peculiarly liable to contusion between the olecranon and inner condyle.

(4) Dislocation of the *radius and ulna forwards*, was considered impossible without a fracture of the olecranon, this opinion having been taught by Sir A. Cooper and Vidal (de Cassis); but, Monin, Prior, Velpeau, Canton, and Denucé have each reported one example—five in number. The structural condition of this dislocation requires further elucidation. In Velpeau's case, the head of the radius rested in the coronoid fossa, and the olecranon was carried upwards and a

FIG. 177.



little outwards; whereas in Mr. Canton's case, as depicted in Hamilton's work, the olecranon rested, apparently, on its summit against the forepart of the articular surface of the humerus, and the head of the radius was free lower down in the smaller sigmoid cavity of the ulna; thus constituting a complete dislocation of both bones forwards.

(5) Dislocation of the *ulna alone, backwards*, seldom happens without some dislocation of the head of the radius; yet it is possible that the coronoid process may pass backwards into the

\* British and Foreign Med.-Chir. Review, Jan., 1866.

olecranon fossa. (Fig. 177, an old unreduced dislocation. A. Cooper.) In one recorded dissection of such dislocation, observes Professor Pirrie, the coronary, oblique, and part of the interosseous ligaments were torn: the brachialis muscle was stretched under the humerus, and the triceps much relaxed.

(6) Dislocation of the head of the *radius alone, backwards*.—This dislocation (Fig. 178), is of rare occurrence, only 28 supposed examples having been collected. One only has been verified by dissection, and this is reported by Sir A. Cooper. The head of the radius was behind the external condyle of the humerus, and rather to the outer side. The



FIG. 178.

coronary ligament was torn through at its forepart, and the oblique had given way. The capsular ligament was partially torn, and the head would have receded much more, but it was supported by the aponeurotic fascia. *Incomplete* dislocation, as occasionally happens in children, may not be attended with rupture of the annular ligament.

(7) Dislocation of the head of the *radius alone, forwards*—is relatively more common than backward dislocation. The head of the radius lies in front of the humerus, and generally somewhat outwards. (Fig. 179.) The anterior and external lateral ligaments, with the annular, are, generally, more or less torn. Sometimes, the two former are alone broken, the annular ligament also being sufficiently stretched to allow of complete dislocation; or, the anterior and annular having given way, the external lateral remains intact.

FIG. 179.



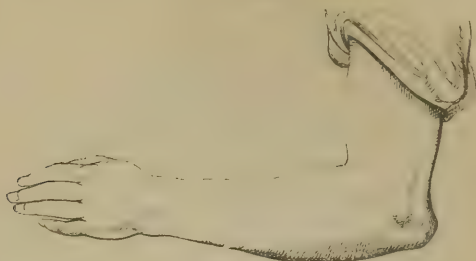
(8) Dislocation of the head of the *radius alone, outwards*—is generally a modification of, if not consequent on, forward dislocation, or, perhaps, backward dislocation. The head rests on the outer side of the external condyle.

**SIGNS.**—Certain characters are common to *all* dislocations of the elbow a resemblance which renders it convenient to take these injuries consecutively, in regard to their signs, as showing more clearly their diagnosis.

Dislocation of the radius and ulna, *backwards*, presents a projection of the elbow *posteriorly*—corresponding to the extremities of both bones, and of the olecranon in particular; with another projection, the end of the humerus in front of the elbow. (Fig. 180.) There is also some shortening of the forearm, semi-flexion, approaching to a right angle

occasionally, and semi-pronation; with loss of the motions of flexion and extension, pronation and supination, but an unnatural lateral motion can generally be produced.

FIG. 180.



Dislocation of the radius and ulna, *outwards*, is characterized by an unnatural projection *externally*—the head of the radius, with a prominent projection *internally*—the inner condyle; while dislocation of the radius and ulna *inwards*, is distinguished by the opposite characters—a projection *internally* of the olecranon, and prominence *externally* of the outer condyle.

The forearm is shortened; on its inner aspect in outward dislocation, and on its outer aspect in inward dislocation; or the whole forearm is shortened, in either of these dislocations upwards. In both, there is also semi-flexion, and semi-pronation.

FIG. 181.



Dislocation of the radius and ulna *forwards*, would seem to be characterized, by *disappearance* of the olecranon *posteriorly*, and the detection of this process and the head of the radius in front of the elbow; with shortening of the forearm upon the arm, semi-flexion to a right angle, and marked supination. If accompanied with fracture of the olecranon, there will be some mobility and crepitus.

Dislocation of the *ulna* alone, *backwards*, would probably be recognised by projection of the olecranon, the head of the radius being felt to rotate in its place; by the inclination of the *forearm* to the *ulnar side*, with partial flexion, and complete pronation. If accompanied with fracture of the coronoid process, there will be considerable mobility, the dislocation readily disappearing and recurring, with crepitus.

Dislocation of the *radius* alone, *backwards*, is characterized by a projection of the head of the bone *behind* the outer condyle, where it can



be felt to rotate; while dislocation *forwards*, is distinguished by a projection of the head of the bone in *front* of the humerus. In *both* dislocations, the forearm is shortened slightly on its outer side, and inclines to *that side*, with slight flexion, and pronation. (Fig. 181.) But the latter form of dislocation is distinguished by the position of the head of the radius, and the impossibility of flexing the forearm beyond a right angle, where the head of the bone impinging on the humerus brings this motion suddenly to a deadlock. This peculiarity was first shown me, when a student, by Mr. Morton, in a case many years since at the University College Hospital; and it was a well-marked sign in another case under my own observation and treatment at the Royal Free Hospital.

Dislocation of the head of the radius, *outwards*, may be recognised chiefly by the position of the head on the outer side of the external condyle, immediately under the skin, where it can be felt to rotate.

*Causes.*—*Indirect* violence is, probably, more commonly the cause of all these dislocations. Thus, a fall on the hand may drive both bones backwards; possibly, outwards or inwards; the ulna alone backwards; or the radius alone backwards or forwards. But the position of the forearm, with regard to pronation or supination, will also affect the direction of the dislocation. Thus, the former position facilitates dislocation of the radius forwards; and a violent effort to supinate the forearm, while it is grasped and held firmly in a state of pronation, will occasion dislocation of the radius backwards. Twisting or wrenching of the forearm, as by machinery, may also occasion dislocation of both bones outwards or inwards; and less probably of either bone, the radius, in particular, backwards or forwards. The latter dislocation of this bone has been produced in children, by lifting the child suddenly from the floor by the hand, or an attempt to sustain the child when about to fall.

*Direct* violence may also be the cause of most forms of elbow-joint dislocation. Thus, both bones may be thrown backwards, by a blow upon the back and lower part of the humerus; or on the front and upper part of the forearm; or the bones are usually thrown outwards or inwards, by a blow on the side of the arm or forearm opposite to the direction of dislocation; and, in like manner, the radius alone has been started backwards, by a blow upon the front and upper part of that bone; or forwards, by a blow upon the back of the head of the radius.

Two dislocations of the elbow, I have omitted to notice, in thus describing the etiology of these injuries. Dislocation of the radius and ulna *forwards*, is, however, too rare an accident to be included in any general statement. In Velpeau's case, the man was knocked down by a carriage, the wheel passing over his right arm. Dislocation of the head of the radius, *outwards*—the other exceptional form of injury—is a modification of, or consecutive to, dislocation of that bone, forwards or backwards.

*Unreduced* elbow-joint dislocations are, probably, no exception to the pathological law of Dislocations in general; that the bones gradually adapt themselves to the particular displacement, forming a new articulation; with more or less recovery of the use of the limb. An unreduced dislocation of both bones backwards, and of seven years' duration, is depicted in Liston's Surgery. The movements of the hand were considerably regained. The structural condition acquired in such cases remains to be shown by dissection; no opportunity, I believe, having hitherto offered for this purpose. *Reduced* dislocations of the elbow generally result in a complete recovery of the use of the joint, within a few weeks.

But in one of several exceptional cases under Hamilton's observation, a dislocation of both bones backwards was easily and promptly reduced in a lad eight years old; yet, six months afterwards, the arm had become bent to a right angle, and quite stiff at the joint. Four years later, the stiffness still continued with only slight improvement.

*Treatment.*—Reduction of all the dislocations to which the elbow-joint is liable, can be effected by the same method—bending the elbow over the knee—but those of the radius are, perhaps, better accomplished in another way.

(1) Bending the elbow over the *knee*, was the method recommended by Sir A. Cooper. The patient being seated on a low chair or stool, the Surgeon resting one foot on the seat, places his knee in the bend of the dislocated joint; grasping the forearm, he presses the knee against the inner side of the forearm to unlock the ulna from behind the humerus, and drawing or bending the forearm round the knee, the bones readily come forward over the articular end of the humerus, into position. The action of the muscles will, in fact, effect reduction, when the bones are dislodged.

Another method, which seems to be a modification of the preceding, was that recommended by Boyer. Extension is made from the wrist by one assistant, the forearm remaining at a right angle with the arm, while counter-extension is made by another assistant holding the arm; the Surgeon grasping the elbow with both *hands*, presses the olecranon process downwards and forwards. This method does not so readily unlock the bones, and extension from the wrist tells more upon the radius than the ulna, which chiefly opposes reduction. It is, therefore, preferable to grasp the middle of the forearm with both hands, and draw it *forwards*; no assistant being required except, perhaps, to steady the arm.

(2) Dislocations of the radius alone, may be reduced by straight extension gradually from the wrist, the arm being fixed; aided by pressure on the head of the bone forwards or backwards, according to the dislocation. In backward dislocation also, forcible supination will aid in just throwing the head of the bone forwards over the articular surface of the humerus; while, in forward dislocation, forcible pronation will similarly jerk the head into place. But these movements are useless until the head lies on the brink of reduction, and unless while extension is still being continued.

After reduction has been effected, it should be maintained by the application of a right-angled splint upon the back of the arm and forearm, with a compress over the head of the bone—in the case of radial dislocations; and the forearm supported in a sling. The period for removal of this retentive apparatus should be regulated by the liability to re-dislocation, and to stiffness of the joint.

Dislocation with *fracture*, as of the coronoid or olecranon process of the ulna, may be treated in the same way; but retention of the bone in position must be continued for some weeks.

*Unreduced Dislocations of the Elbow*, are curable or incurable; partly according to their duration, principally however with reference to the form of dislocation. Recent dislocation of the ulna or involving the ulna, is much more difficult of reduction, than that of the radius after a long period; the difference being due to the irregular form of the head of the ulna which opposes reduction. Dislocation of the radius alone has been reduced at *periods* varying from a few days to weeks or months. In one

instance I reduced a dislocation backwards, of ten weeks' duration, and the patient, a laundress, recovered good use of her forearm. Dislocation of the radius forwards, has remained unreduced in the hands of skilful Surgeons. Sir A. Cooper failed in two recent cases; and of the six which came under his immediate observation, only two were ever reduced. Malgaigne states that in a collection of 25 cases, efforts at reduction were ineffectual in 11, and the accident was unrecognised or neglected in 6; leaving only 8, of the whole number, reduced. The golden rule should be observed in elbow-joint dislocations, as in all other such injuries, not to interfere when the motions of the joint are tolerably efficient.

*Compound Dislocations of the Elbow.*—These injuries are always perilous; both on account of their nature, the size of the joint, and as being caused by considerable violence. (Fig. 182.) The “external-latero angular” dislocation, which I have described, was compound, and produced by a wrench of the forearm between the buffers of two railway carriages.

FIG. 182.



*Treatment.*—These compound injuries present nothing peculiar in relation to their treatment. The preservation of the limb, or operative interference, by excision or amputation, must be guided by similar considerations to those which relate to shoulder-joint dislocations, or to such injuries in general.

*Congenital* dislocations of the elbow have been met with, in the form of both bones backwards, or as pertaining to the head of the radius. These imperfections are more curious pathologically, than interesting surgically.

**DISLOCATIONS OF THE INFERIOR RADIO-ULNAR ARTICULATION.**—The head of the radius in its relation to the smaller sigmoid cavity of the ulna, constituting the *superior* radio-ulnar articulation, may undergo dislocation in the directions already described, as dislocations of the head of the radius,—backwards, forwards, or outwards.

The *lower end* or head of the ulna in its articulation with the lower end of the radius, is liable to dislocation, backwards or forwards.

(1) Dislocation *backwards*, is characterized by an unnatural prominence of bone—the head of the ulna, at the posterior and inner part of the wrist, with loss of the motions of pronation and supination. In connexion with *fracture* of the lower end of the radius, this dislocation is not very uncommon; alone, it seldom occurs, 11 or 12 cases only having been collected by Malgaigne.

The *cause* would seem to be violent pronation. Thus, Desault records the case of a laundress who in wringing a wet sheet, produced dislocation of the head of the ulna backwards.



*Treatment.*—Reduction can be readily effected by forcible supination of the forearm, with pressure on the head of the ulna forwards. Generally the bone remains in place without further assistance; or it may be necessary to apply a compress and splint.

(2) Dislocation *forwards* is denoted by a projection of the head of the ulna at the anterior and inner part of the wrist; the natural prominence of this portion of the bone at the back of the wrist having disappeared. The motions of pronation and supination are lost. This dislocation is even more rare than the former; 9 cases only having been collected by Malgaigne, to which Hamilton adds 1 more, as reported by Parker, of Liverpool.

The *cause* is apparently, with hardly any exception, violent supination of the forearm. And this mode of production throws light on the comparatively less frequent occurrence of this dislocation; the motion of supination being less extensive than that of pronation, and less likely to be excessive in any of the offices which the hand has to perform.

*Treatment.*—Reduction is easily effected by forcible pronation of the forearm, with pressure on the head of the ulna backwards.

Redislocation need not be apprehended. There was no such tendency in Mr. Parker's case.

DISLOCATIONS OF THE RADIOCARPAL ARTICULATION, OR WRIST-JOINT.—This articulation may undergo dislocation backwards, or forwards.

(1) Dislocation of the hand and carpus, *backwards*, presents a large projection, the carpus at the back of the wrist, and another, the lower

FIG. 183.



end of the radius and ulna on the palmar aspect (Fig. 183 and Fig.

FIG. 184.



184); with flexure and immobility of the hand. (2) Dislocation of the hand and carpus, *forwards*, presents just the opposite appearances; a projection of the carpus in front of the wrist, and of the radius and ulna on the dorsal aspect (Fig. 185), with extension and immobility of the hand.

*Causes.*—A fall on the hand is the usual occasion of dislocation;

the back of the hand, probably, receiving the force of the shock in backward dislocation of the carpus; and the palm of the hand receiving the force in forward dislocation. These dislocations are usually said to arise conversely; but the cases described in Hamilton's work appear to clearly disprove the accepted representations in most surgical works.

*Treatment.*—Reduction can generally be effected in either form of dislocation by extension and counter-extension; position should then be maintained by antero-posterior splints securing the hand.

Fig. 185.



#### INJURIES OF THE WRIST ALLIED

to DISLOCATION.—(1) *Dislocation, with fracture* of the lower end of the radius, happens far more commonly than dislocation alone. The diagnosis will turn on the presence of crepitus and mobility of the lower fragment, as determined by moving the hand, at the same time feeling whether the styloid processes of the radius and ulna move with it. Dislocation with fracture of the posterior margin of the articulating surface of the radius, is known as "Barton's fracture." Some difficulty may be experienced in keeping the bones in place.

(2) *Fracture* of the lower end of the radius may be mistaken for dislocation of the wrist; but it can be distinguished in like manner. The comparative frequency of the former injury and rarity of the latter, led Dupuytren to almost deny the possibility of radio-carpal dislocation; though the occurrence of this dislocation is now established beyond a doubt.

(3) *Fracture with impaction* of the fragments is unattended with the usual fracture signs, mobility and crepitus; but it may be distinguished from dislocation, chiefly, by the resistance offered to reduction.

(4) *Sprain*, also, simulates dislocation: here, however, the swelling is single, and not well defined, like the bony projections of dislocation; it does not appear immediately, and gradually increases.

*Compound Dislocation of the Wrist.* This accident is of rare occurrence. One case only has been seen by Hamilton, and one recorded by Sir A. Cooper. As associated with fracture, the injury may happen more frequently. Always a serious injury, compound dislocation is even more so in consideration of the violence which causes it.

*Treatment.*—The amount of damage done to the soft textures and to the bones, will guide the Surgeon respecting the probability of preserving the hand, or the necessity for *excision* or *amputation*.

*Congenital* dislocations of the wrist, are described by Guérin as, possibly, occurring in three forms; forwards, backwards and upwards, backwards and outwards. These dislocations are connected with, and dependent on, imperfect conditions of the radio-carpal articulation, or incomplete paralysis of the muscles of the forearm and hand.

DISLOCATIONS OF THE CARPAL BONES, AMONG THEMSELVES.—Simple dislocations or rather subluxations of the carpal bones take place, it is said, occasionally; but, perhaps, only in one direction—backwards.

The bones thus liable to dislocation are; the semilunar, cuneiform, and pisiform bones of the first row, and the os magnum of the second row, which is most frequently displaced. Dislocation of any of the carpal bones may occur, in connexion with gunshot injury, or other occasions of extensive fracture of the neighbouring bones.

The *Signs* will be; a bony projection at the back of the wrist, with some loss of power.

The *Cause* is usually a fall on the back of the hand, which being thus forcibly doubled under itself, occasions one of the carpal bones to start backwards; the os magnum, for example.

*Treatment*.—Pressure may easily replace the bone, but the application of a compress, and for some time, will be necessary, to guard against redislocation; the os magnum, in particular, having a great tendency to slip out again.

DISLOCATIONS OF THE METACARPAL BONES *at their Carpal articulations*.—Any such dislocation is rare, and usually limited to a single metacarpal bone, *backwards*. The *thumb* is most commonly dislocated, and either *backwards* or *forwards* on the trapezium; the former displacement occurring more frequently.

The *Signs*, in any case, are sufficiently obvious; projection of the end, or *base*, of the metacarpal bone, in the direction of displacement, and immobility.

*Causes*.—A fall on the thumb bending it on itself, represents the ordinary mode of its dislocation. A blow upon the extremity and palmar aspect of the last phalanx may, however, cause dislocation; the force then acting in the opposite direction, or from within outwards.

*Treatment*.—Extension, with pressure on the end of the bone, will generally succeed in effecting reduction. A splint should then be ap-

plied, and perhaps a compress to prevent any risk of redislocation. The bulky base of the metacarpal bone of the *thumb* sometimes obstinately resists reduction; in which case, Sir A. Cooper recommends that the dislocation should be left to acquire the compensatory motion of a new joint,

rather than the Surgeon run any risk of injuring the nerves and blood-vessels, by dividing the muscles or ligaments.

FIG. 186.



FIG. 187.



DISLOCATIONS OF THE FIRST PHALANGEAL BONES —*at the Metacarpo-Phalangeal articulations*.—These dislocations, also, seldom happen; and usually, the bone is driven *backwards* (Fig. 186), though sometimes *forwards*. (Fig. 187.) I have seen the phalangeal bones



of the index and middle fingers partly driven back, in the left hand of a prizefighter. The first phalangeal bone of the *thumb* is most frequently dislocated, and either *backwards*, or *forwards*; the former displacement occurring more commonly. Hamilton has met with the backward dislocation seven times, the forward only twice.

The *Signs* are characteristic; a projection of the posterior extremity of the phalangeal bone, in the direction of displacement, and immobility. The *thumb* presents somewhat peculiar appearances. Its first phalangeal bone, having slid backwards upon the metacarpal bone, stands off from this bone at an angle; thus allowing the *head* of the metacarpal bone to project prominently towards the palm of the hand; while the second or ungual phalangeal bone is flexed upon the first, and forms another angle in the thumb. The phalangeal bone is locked in its new position, and reduction may be proportionately difficult. This immediately arises either from the constriction of the neck of the bone between the lateral ligaments, as Hey believed; or between the two heads of the short flexor, as affirmed by Malgaigne, Vidal (de Cassis) and others; or from the interposition of the anterior ligament torn from its attachments and folded in between the joint, as alleged by Pailloux and many others. Displacement of the long flexor tendon inwards or outwards, so as to impede reduction, has been found by Lisfranc, Deville, and Wadsworth.

*Treatment*.—Reduction can sometimes be accomplished easily; by extension, inclining the finger towards the palm, with pressure on the displaced end of bone. (Fig. 188.) Or, the thumb may require more

FIG. 188.



powerful traction; as by means of a strong tape fastened on the phalanx with a clove-hitch knot (Fig. 189), care being taken to protect the skin by a piece of moist wash-leather wrapped round the part. Or pulleys may be had recourse to, applied in like manner. A more effectual mode of extension occasionally, is by means of a large door-key; which, I believe, Mr. Liston originally suggested. Passing the ring of the key over the thumb, and hitching it against the projecting end of bone; extension and pressure can thus be brought to bear advantageously, and simultaneously. Before applying any such extending force, reduction may be facilitated by soaking the thumb for some time in warm

FIG. 189.



water, in order to relax the parts as much as possible; a very useful recommendation given by Sir A. Cooper.

*Subcutaneous section* of the opposing ligaments or tendons, should be resorted to as the last resource. It was employed successfully by Mr. Liston in a recent case—not an hour having elapsed, the patient an old man and very drunk; no resistance, apparently, to reduction existed, and very powerful force had been applied and persevered in without avail. At last, the external lateral ligament was divided by the point of a very narrow and fine bistoury; and then replacement became immediate and easy. Some inflammation followed, but was kept within bounds, and the man regained the use of the articulation.

DISLOCATIONS OF THE MIDDLE, AND UNGUAL, PHALANGEAL BONES, occur even less frequently than dislocations of the first row. Their pathology, signs, and treatment, are similar.

*Compound Dislocations of the Bones of the Hand.*—Those of the *thumb* are most common, as they are also the most serious and important with regard to the future use of the hand. But any such dislocation is usually connected with fracture, and extensive laceration of the palm.

The *causes* of these injuries are always some occasion of extreme violence. The explosion of a flask of powder in the hand happens now and then, driving one or more of the bones backward, and otherwise shattering the hand. I have had to deal with two such accidents.

*Treatment.*—*Reduction* can usually, be effected without difficulty; the obstacles of ligaments or tendons having already given way as part of the injury. The wound should then be closed, and the joint fixed, as in ordinary compound dislocations. Generally, however, the extent of injury requires some operative interference. *Excision* of splintered portions of bone, or *amputation* of one or more fingers, may therefore become unavoidable alternatives. The preservation of the thumb, and perhaps of the little finger with it, is always a consideration of paramount importance. This remnant hand will serve the useful purpose of a hook, or of prehension by the conjunction of the thumb and finger.

*Congenital Dislocations of the Fingers.*—The last three fingers of the left hand in a fœtus examined by Chaussier, were found to be dislocated at the metacarpo-phalangeal articulation. The thighs, knees, and feet were also dislocated. The last two phalanges of the fingers are, M. Bérard states, incurved backwards, occasionally, in newly-born children of the female sex; and Malgaigne has himself seen a woman in whom from birth, all the *phalangettes* were carried backwards to an angle of  $135^{\circ}$ , leaving the heads of the phalanges projecting forward under the skin.

DISLOCATIONS OF THE PELVIS.—(1) The *Symphysis-pubis*, and the *Sacro-iliac Articulations*; may, severally, undergo separation and displacement. In one case, I found all three articulations completely separated, in a young man whose pelvis had been subjected to severe compression.

The *Signs* of any pelvic disarticulation are sufficiently obvious; some deformity and mobility at the seat of injury.

The *cause* of disarticulation is always some extreme violence, and generally a compressing force.

*Treatment.*—The same as in fracture of the pelvis.

(2) The *Coccyx* is more frequently bent or displaced than fractured. Such dislocation may be *forwards*, as the result of a fall; or *backwards*, in consequence of pressure by the head of the child during parturition.

*Treatment.*—The same as for fracture of the coccyx.

DISLOCATIONS OF THE HIP-JOINT.—This joint is subject to four principal dislocations; and to five anomalous dislocations; resulting from the freedom of motion of the hip—as a ball-and-socket joint—in all directions. The number of *possible* dislocations may therefore be added to by increasing experience; any point in the circumference of a circle representing a direction in which dislocation of the hip might possibly occur, from the joint as a centre. Taking the four principal dislocations of the hip, in their order of frequency, they are as follow :—

(1) Dislocation, upwards and backwards on the *dorsum ilii*; (2) upwards and backwards into the great *ischiatric notch*; (3) downwards and forwards into the *obturator foramen*; and, (4) upwards and forwards upon the *pubes*. To these may be added, as anomalous and occasional dislocations; (5) Dislocation, *directly upwards*, between the anterior superior and inferior spinous processes of the ilium, or thereabouts; (6) *downwards* and *backwards*, upon the posterior part of the body of the ischium, between its tuberosity and its spine; (7) downwards and backwards, into the lesser or *lower ischiatic notch*; (8) directly downwards, beneath the lower border of the *acetabulum*; (9) and, forwards, into the *perineum*. The first four-named dislocations severally require special consideration; but even their relative frequency is very different. Sir A. Cooper states that in 20 cases of hip-joint dislocation; 12 will be on the *dorsum ilii*, 5 into the *sciatic notch*, 2 into the *thyroid foramen*, and 1 upon the *pubic bone*.

DISLOCATION UPWARDS AND BACKWARDS; (1) ON THE DORSUM ILII, AND (2) INTO THE GREAT ISCHIATIC NOTCH.—*Structural conditions.*—(1) The head of the femur rests on the *Dorsum Ilii*, or within the fibres of the deeper gluteal muscles; and it is directed backwards, the great trochanter forwards. (Fig. 190.) The capsular ligament, and especially its posterior half, is lacerated, and the round ligament ruptured; the small external rotator muscles are stretched or rent completely asunder, and the *gluteus maximus*, *medius*, and *minimus* torn up more or less in extent from the *dorsum ilii*; thus allowing the head of the femur to occupy its unnatural situation. The *triceps adductor* is put upon the stretch. The particular direction of the head backwards and trochanter forwards, has been attributed to the strong anterior portion of the capsule which proceeds to the anterior intertrochanteric line, still remaining entire; and thus resisting the action of the rotator muscles. Resistance to reduction in this, and other dislocations of the hip, has been ascribed either to the rent capsular ligament entangling the head and neck of the bone; or to opposing muscles; or to both this ligament and the muscles.

FIG. 190.



(2) Dislocation into the great *Ischiatic Notch*, corresponds so nearly



in its pathology, with that on the dorsum ilii, as to require only a *differe*ntial description. The head of the femur lies in the great sciatic notch, behind and a little above, the acetabulum; being situated between the upper margin of the notch above, and the sacro-sciatic ligaments below. (Fig. 191.) It rests upon the pyriformis muscle; or upon the gemelli and sacro-sciatic nerve, as in a case dissected by Mr. Syme. The attitude of the bone, and rupture of the ligaments and muscles, are very similar to the condition of dorsal dislocation.

FIG. 191.



FIG. 192.



*Signs.*—(1) Dislocation on the *dorsum ilii* presents very characteristic appearances. The limb is shortened to an extent varying from one inch and a half as the average, to three inches occasionally; the knee is slightly flexed, and the thigh upon the abdomen, thus projecting the knee forwards; there is marked inversion of the limb, the knee being directed inwards, as well as forwards, towards the other, and just above it, the foot also is inverted, so that the great toe rests on the opposite ankle. (Fig. 192.) The head of the femur in its new situation, with the gluteal muscles, give an unnatural prominence to the posterior aspect of the buttock, and the bone can be felt, especially on rotating the limb; the prominence of the great trochanter is diminished, and drawn upwards and turned forwards near the anterior superior spinous process of the ilium. Immobility of the limb, at least in the direction of eversion, abduction, and extension, will be more or less complete; and the patient has lost the power of such voluntary motion; great pain also attends almost any movement of the limb. (2) Dislocation into the great *sciatic notch*, presents similar signs, but in a lesser degree; thus rendering the characteristic appearances less marked. Shortening has taken place to an extent usually of half an inch, and not exceeding an inch. Flexion and inversion

are such, that the axis of the dislocated thigh points the knee more across the opposite thigh, and the end of the great toe rests on the ball of the great toe opposite. (Fig. 193.) The hip appearances are less conspicuous; the head of the femur sinking into the hollow of the notch, and the great trochanter approaching less nearly to the anterior superior spinous process of the ilium.

FIG. 193.



The *diagnosis* of these dislocations from other injuries is, generally, clear. *Fracture* of the neck of the femur accompanied with *inversion* of the limb, is comparatively rare; and when it occurs, mobility and crepitus of the fragments will, usually, determine the diagnosis. *Impacted fracture*, however, with consequently an absence of these signs, is always an equivocal condition. Two points of distinction between dislocation of the hip upwards and backwards, and impacted fracture, are laid down by Erichsen; that in dislocation, the head of the bone can be felt in its new situation by deep manipulation of the gluteal region; and that the trochanter is diagonal in its relative position to the anterior superior spinous process, but, in fracture, it lies nearly in a perpendicular line with it. *Disease* of the hip-joint resembles dislocation upwards and backwards, in its general characters; and particularly when advanced to the stage of shortening of the limb. The antecedent history of limping lameness and pain, before any such resemblance becomes established will sufficiently decide the diagnosis. Failing to recognise the nature of the case, instances have occurred of attempted reduction in hip-joint disease; a sad mistake, and which would sorely aggravate the disease.

**CAUSES.**—The attitude of the limb at the time of dislocation is always most influential in this, as in other such injuries. When the body is bent forward on the thigh or the thigh on the abdomen, and the thigh in a state of adduction close to the opposite thigh; hip-dislocation upwards and backwards may, then, result from a fall on the foot or knee, and especially while the individual is carrying a load on the back; or from the fall of a heavy weight, as a mass of earth, upon the back of the pelvis, the body being much bent forwards. Dislocation may thus take place either on the dorsum ilii, or into the great sciatic notch; but, to gain the latter situation, the limb must be in a position more nearly at a right angle with the trunk.

*Unreduced* dislocation of the hip backwards proceeds to the formation of a new joint; the pathology of which may be regarded as the type of any such compensatory construction, and is, therefore, considered in the general history of **DISLOCATION**.

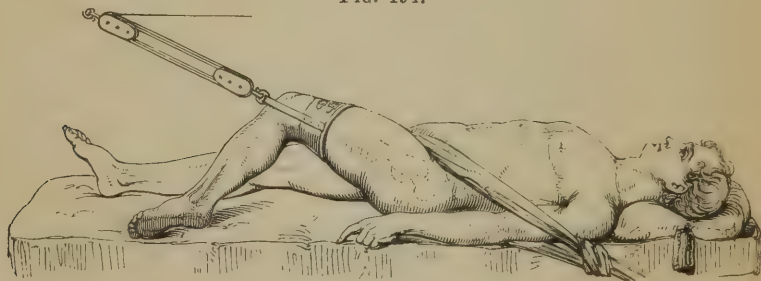
Cases are on record showing the efficiency of the limb eventually, in a

state of unreduced dislocation; one—related by Hamilton—after nine years dislocation on the dorsum, where a young man could walk rapidly, although with a halt, yet without pain and discomfort; in another case, after only eight weeks' dislocation into the sciatic notch, the limb was quite useful. Reduction of dislocation on the dorsum, is, generally, followed by speedy recovery of the use of the limb; in the course of a few weeks or months at most, the limb becoming as sound and useful as before. The same may be said in favour of dislocation into the sciatic notch; reduction soon restores the thorough efficiency of the limb.

TREATMENT.—Chloroform should always be administered — unless specially contra-indicated—to relax the muscles. A warm bath may be substituted for the relaxing influence of chloroform, in exceptional cases. *Reduction* can then be effected in either of two ways; by extension and counter-extension of the limb, pulleys being necessary to overcome the muscular resistance and its duration, in most cases; or by flexing the limb on the thigh, and guiding it so into position, that the muscles themselves, probably, complete the reduction—constituting the method by “manipulation.”

(1) *Extension and Counter-extension.*—The patient must be placed on his back, inclining to the side opposite to that of dislocation; and sufficiently raised from the ground on a bed or table, that the long axis of the thigh may be in a line with the force of extension, resisted by counter-extension, which should be applied in the following manner. (Fig. 194.) A padded belt is fastened round the lower part of the thigh, having a double strap attached to it, terminating in a ring; to the latter a multiplying pair of *pulleys*, of three cords, is hooked, whereby extension is brought into operation; the distal pulley being hooked to a ring or *staple* driven into the wall or some firmly fixed object, in a line with the thigh. A padded *perineal band*, for counter-extension, must be secured in like

FIG. 194.



manner. An apparatus of this kind, and well adapted for the purpose, is manufactured by Messrs. Weiss. The cord of the pulleys may be entrusted to an assistant, the Surgeon taking charge of the thigh and hip. Extension should be made *slowly*, gradually increased, and steadily maintained. The great trochanter will be observed to descend and to come more into position, as extension proceeds; the upper part of the thigh should then be raised with one hand or by means of a towel passed under the thigh, in order to lift the head of the femur over the prominent brim of the acetabulum; while at the same time rotating the thigh outwards, with the other hand, thus to incline the head of the bone downwards and



forwards; it will, generally, be felt to slip in with a jerk, rather than a snap, the muscles being worn out beyond the power of any sudden contraction. On relaxing the extension, the perceptible disappearance of the signs of dislocation, in the length of the limb, &c., announces the certainty of reduction. The limb must then be retained in position, to guard against the liability of re-dislocation. A long splint and bandage, as for fracture of the thigh, has been recommended for this purpose; but simply connecting the reduced limb with the sound limb, by means of a few turns of a bandage around the thighs side by side, I have always found to afford a sufficient security. The patient must remain in bed for ten days or a fortnight, during the reparation of the ligamentous and other tissues.

Dislocation into the *sciatic notch* is accomplished in like manner, but with greater difficulty, owing to the imbedded position of the head of the femur. (Fig. 195.) Extension should be made across the middle of the opposite thigh, and the head of the bone more lifted out of its bed; the patient inclining more to the opposite or sound side. To effectually raise

FIG. 195.



the head of the bone, it is sometimes recommended, that a towel passed under the thigh, should be looped round the neck of an assistant, who stooping over the pelvis and pressing downwards with both hands, raises his shoulders; thus bringing considerable power to bear in drawing the bone forwards towards its socket.

*Manual* extension may succeed, especially if aided by the influence of chloroform, in effecting reduction of hip-joint dislocation. This alternative extending force is, therefore, a valuable resource in the absence of pulleys, which cannot always be at hand. I thus succeeded in reducing a dislocation of the hip, on the *dorsum ilii*, and of twenty-four hours' duration, where also the belt and straps, which were new and sound, had given way in using them.

(2) *Manipulation*.—This method of reduction was known to Hippocrates, and has since been variously practised by Surgeons in modern times; but, in 1851, Dr. W. W. Reid of Rochester, N. Y., so attracted the attention of the profession to this proceeding, as to have fairly introduced it as an established method of practice.

Dr. Reid's method consists:—"In flexing the leg upon the thigh, carrying the thigh over the sound one, upwards over the pelvis as high as the umbilicus, and then abducting and rotating it outwards."

Hamilton's description of the proceeding is this:—"The patient being laid on his back upon a mattress, the Surgeon—assuming that it is a dislocation on the *dorsum ilii*—should seize the foot with one hand and the

other he should place under the knee; then, flexing the leg upon the thigh, the knee is to be carefully lifted toward the face of the patient until it meets with some resistance; it must then be moved outwards and slightly rotated in the same direction until resistance is again encountered, when it must be gradually brought downwards again to the bed. We do not know that the whole process could be expressed in simpler or more intelligible terms, than to say, that the limb should follow constantly its own inclination."

In attempting the reduction of dislocation into the *sciatic notch*, by manipulation, the same author warns us of the special danger, "that the head of the bone will be thrown across into the foramen thyroideum."

"The following summary of a paper—prepared by Dr. Hamilton—with the view of determining, if possible, the relative value of the two methods—manipulation and extension—and exhibiting an analysis of 64 cases in which manipulation was employed, will enable the reader to form some estimate of the difficulty in which this subject is involved; and if it does not actually decide a moot-point, it will at least demonstrate that the method by manipulation is not without its hazards. Of 41 cases in which the fact is stated, 28 were reduced on the first attempt, 7 on the second, 4 on the third, and 2 on the seventh. In 7 examples, the head of the femur has been thrown from one position to another upon the pelvis, travelling from the dorsum ilii to the ischiatic notch, and from thence to the foramen ovale; or directly from the dorsum to the foramen, and back again; or in other directions, according to the character of the original dislocation; in some instances these changes being made as often as seven times in succession. In the majority of cases, no evil consequences seem to have followed upon these changes of position."

FIG. 196.



DISLOCATION DOWNWARDS AND FORWARDS INTO THE OBTURATOR FORAMEN.—*Structural Condition.*—The head of the femur lies in front of the obturator foramen, lodged upon the obturator externus muscle, the ball being directed inwards and the great trochanter outwards. (Fig. 196.) The capsule has given way, especially on its inner side, and the round ligament is torn from its attachment; but the constancy of the latter lesion is disputed.

*Signs.*—This dislocation, also, presents very characteristic appearances. The limb is lengthened from one to two inches in extent, the knee bent, and the body inclined forwards—apparently to relax the painful tension of the psoas and iliacus muscles; and the whole limb is in advance of the other, and much abducted, the foot usually points forwards, but occasionally it is slightly everted. (Fig. 197.) The head of the femur can be felt in its new situation, particularly

in thin persons; and the prominence of the great trochanter has disappeared entirely, presenting a marked flattening of the hip, or a depression in the situation of the trochanter.

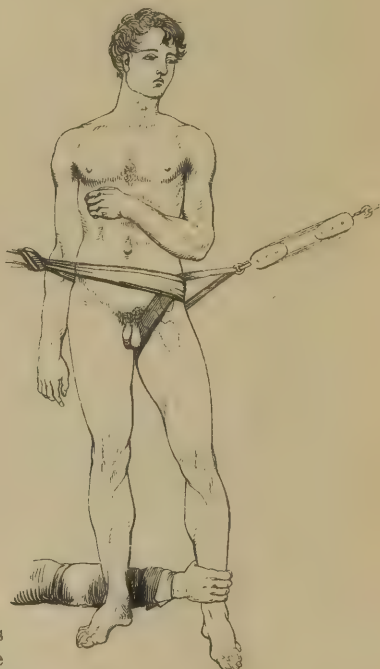
*Causes.*—The limb must be in a state of abduction, at the moment of

injury. Any force from below, or acting on the back, may then produce dislocation downwards and forwards, into the obturator foramen. Thus, a fall from a horse, with the thigh under the body of the animal, has had this effect; and Pirrie once found it caused by the person jumping in great haste out of bed, and while the left foot reached the floor, the right was entangled by the blankets in bed, thus separating the legs and thence producing dislocation into the obturator foramen. The fall of a heavy weight upon the back of the pelvis when the body is bent forwards and the thighs are apart, will also produce the dislocation.

FIG. 197.



FIG. 198.



*Treatment.*—(1) The patient is laid on his back. *Extension* must be made upwards and outwards by a perineal girth connected with the pulleys; and counter-extension maintained by another belt around the pelvis from the dislocated side. As the head of the bone is thus drawn towards its socket; the Surgeon passing his hand behind the sound limb, grasps the ankle of the dislocated limb, and drawing it inwards and backwards towards the middle line, thus throws the head of the bone outwards and upwards to the acetabulum. The limb is here used as a long lever, over the resisting perineal girth, as a fulcrum. (Fig. 198.) This is Sir A. Cooper's method of reduction. Other methods have been devised, but they do not correspond more nearly to the direction of the displacement.

In the absence of pulleys, however, it is well to have other resources, as follow:—

(2) Let the patient sit upon the front of the bed, astride one of the bed-posts, and grasp it; while extension of the limb is made by two



assistants. Then, the Surgeon crossing the limb over the sound one, and rotating it outwards, may thus succeed in reducing the dislocation. This method was proposed and practised with success by Mr. Hey, of Leeds, in one case.

(3) Manipulation seems to have succeeded in another case. Mr. Hey flexed the thigh to such an extent as to form an acute angle with the trunk, and then by rotating it, accomplished reduction.

DISLOCATION UPWARDS AND FORWARDS UPON THE PUBES.—*Structural Condition.*—The head of the femur rests on the anterior margin of the horizontal ramus of the pubic bone, with the great trochanter directed backwards. (Fig. 199.) Sometimes, the ball is driven up so high as to be hooked into the pelvis. The capsular and round ligaments are ruptured. In a case, dissected by Sir A. Cooper, Poupart's ligament was torn, so as to allow the head and neck of the bone to pass underneath the iliacus internus and psoas muscles; the anterior crural nerve lying upon these muscles and stretched over the neck. The femoral vessels were to the inner side.

FIG. 199.



FIG. 200.



*Signs.*—The limb is shortened, generally to the extent of an inch; flexed slightly, decidedly abducted, and everted. (Fig. 200.) The globular head of the femur can be plainly felt on the pubic bone, to the outside of the femoral vessels, and made to roll under the fingers by rotating the limb; while the prominence of the great trochanter has disappeared, this portion of the bone being drawn inwards and upwards towards the anterior superior spinous process of the ilium. Immobility of the limb is a marked symptom, as regards rotation inwards; and powerlessness equally so, with pain or numbness frequently, owing to pressure on the anterior crural nerve.

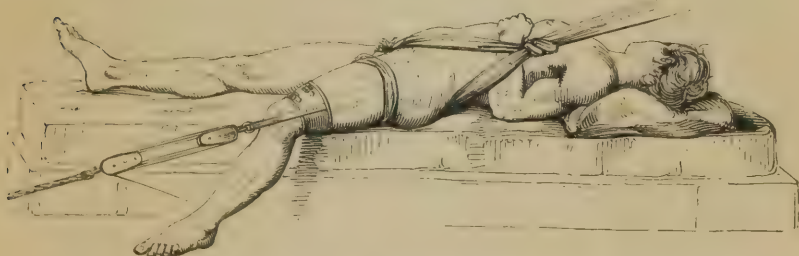
The *diagnosis* from *fracture of the neck* of the femur, may be determined; by the situation of the head of the bone and immobility, with crepitus in the case of fracture; or if the fracture be *impacted*, the head of the bone is still diagnostic.

*Causes.*—When the limb is directed backwards, and perhaps, abducted; dislocation upon the pubes may occur. Either, by a fall on the foot, as when a person slides down from the end of a waggon; or when walking, the foot is suddenly planted into a hole, the pelvis advances, while the upper part of the body is thrown forcibly backwards, in order to avoid a fall. A severe blow on the back of the pelvis may have the same effect in producing dislocation upon the pubic bone.

*Unreduced* dislocation leads to the formation of a tolerably complete new joint. This result was found in the case examined by Sir A. Cooper. Upon the pubes a socket was formed for the neck of the femur, the head being above the level of the pubes. Both the latter portions of bone were flattened; the trochanter also was much altered in shape, and it partly occupied the acetabulum, which was otherwise filled with osseous deposit. This specimen is still in the Museum of St. Thomas's Hospital.

*Treatment.*—The patient lying on his back, with the dislocated side near the edge of the bed; Extension should be made from the lower part of the thigh, downwards and backwards, the pulleys being fixed accordingly; while counter-extension, by means of a perineal girth, is made in the opposite direction, over the body of the patient. (Fig. 201.) This

FIG. 201.



force having, as usual, been applied slowly, gradually increased, and steadily maintained; the head of the bone is lifted over the brim of the acetabulum, by a towel under the upper part of the thigh, and the ball directed backwards, by rotating the thigh inwards.

"Anomalous" Dislocations of the Hip, in the various modified directions already enumerated, occur too rarely to admit of any precise description. The *signs* resemble in various degrees, those of the principal dislocations; and the *treatment*—by extension and counter-extension—must be modified according to the particular direction of dislocation.

UNREDUCED DISLOCATIONS OF THE HIP.—*Two months* was the period fixed by Sir A. Cooper, as the extreme period within which such dislocations can, or should, be reduced. Increasing in difficulty and danger, as the operation of reduction may be up to that time; it subsequently becomes extremely uncertain of accomplishment, and always perilous, owing to the liability of fracture or of abscess, from the straining injury to the soft textures. The former accident has occurred in the hands of some of the most able Surgeons; fracture taking place usually in the neck

of the femur or not far below the trochanters. *Exceptional* cases of successful reduction after a much longer period have more recently been recorded. Thus, two cases are cited by Hamilton, both of *six months* standing, and it may be added, both dislocations on the dorsum ilii.

The physiological consideration which, as a *rule*, should here, as in regard to all Dislocations, guide the Surgeon, is, the *degree of efficiency* of the new joint; as indicating the practicability and safety of attempting reduction, and its utility when accomplished.

*Dislocation of the Hip, with Fracture of the Femur.*—This complication is undoubtedly possible, but exceedingly rare. Reduction of the dislocation is said by Hamilton to be still more rare. The *rule of practice*, however, should always be to attempt reduction at the time of the accident. This may be accomplished, under the influence of chloroform, simply by pressure on the head of the bone and with the requisite manipulation; or, by first setting the fracture and securing it with lateral splints, in order to make use of the limb for extension in reducing the dislocation. Failing at the time of dislocation to effect reduction, union of the fracture must be allowed to take place, and then it should be again attempted. This resource proved successful in one case, a dislocation on the dorsum ilii, of five weeks' duration; Mr. Badley being the operator. In another case, a dislocation into the sciatic notch; reduction at the end of six weeks, as reported by Mr. Thornhill, appears to have been doubtful. It would seem that, probably, he re-fractured the bone; for the head of the femur is said to have resumed its place with a loud *crash*.

*Double Dislocation*—i.e., of both hips, has been known to occur; and in different directions on the two sides, or with fracture of one femur.

*Congenital Dislocations of the Hip-joint* have been met with, complete or incomplete. The former correspond very nearly in their directions with the regular dislocations of the hip, and with one of the anomalous varieties—upward dislocation, in which the head of the femur is placed outside the anterior inferior spinous process of the ilium. These dislocations seem to occur much oftener in females than in males; and usually, they are single.

DISLOCATIONS OF THE PATELLA are liable to occur in four directions; (1)

FIG. 202.



outwards more commonly, or (2) inwards; (3) vertically, the patella turning edgewise on its axis; or lastly, (4) upwards. Both the latter forms of dislocation are very rare.

(1 and 2) Dislocation laterally, *outwards*, or *inwards*. The *structural conditions* in these two forms of Dislocation are analogous; the patella is displaced more or less completely, in either direction, and rests on the outer side of the external condyle (Fig. 202), or the inner side of the internal condyle (Fig. 203), of the femur.

FIG. 203.





*Signs.*—An unnatural swelling—the projection of the patella, can be seen and felt over the outer or inner condyle; with an unnatural depression in front of the knee, owing to the absence of the bone from its proper situation. The knee is much broader than usual, slightly bent, and immovable; considerable pain also is experienced, especially aggravated by any attempt to bend the joint.

*Causes.*—*Muscular contraction* of the quadriceps extensor would seem to be the usual cause of these dislocations. The *outward* displacement is particularly liable to occur in persons who are knock-kneed, or whose external condyles have not the usual degree of prominence anteriorly. Dislocation of the patella in this direction may sometimes be produced *voluntarily*. A dancing girl, who, from her earliest years, had habitually twisted herself into various attitudes, eventually became knock-kneed; and when the rectus muscle acted upon the patella, it was thrown nearly flat upon the side of the external condyle of the femur. Sir A. Cooper—who relates this case—also found the dislocation reproduced in another instance whenever the limb was extended, displacement arising from *distension* of the joint with *synovial fluid*. *Indirect* violence is sometimes the cause; as a sudden twist of the thigh inwards, while the weight of the body resting on the foot, keeps the leg turned outwards; or a fall with the knee turned inwards, and the foot outwards. *Direct* violence, as a blow upon the inner or outer margin of the patella, may sometimes produce dislocation outwards or inwards, respectively.

These dislocations are very prone to recur.

*Treatment.*—Reduction is easily effected. The patient lying on his back, the Surgeon raises the thigh towards the abdomen, so as to relax the quadriceps extensor muscle; and then by pressing the patella inwards, or outwards, over the condyle, it is at once drawn into place by the action of that muscle.

(3) In *vertical* dislocation, the patella turns on its axis and presents edgewise. One margin looks forwards, the other rests and is fixed, in the groove between the condyles. This twist may be more or less complete; whereby the margin of the bone looks obliquely forwards, or turns almost completely round so that the posterior surface of the bone partly becomes anterior. The latter displacement is very rare; and indeed, any vertical dislocation is uncommon, not more than fifteen examples having been recorded.

*Signs.*—Vertical dislocation presents very characteristic appearances; the sharp projecting border of the patella can be clearly felt and seen under the skin; and the leg is forcibly extended, or sometimes flexed slightly.

The same *causes* may turn the bone vertically on its axis, which displace it laterally; and—as Hamilton states—an incomplete lateral may be converted into a vertical dislocation, if the bone hitches on one margin, and the extensor muscle contracts suddenly and violently, thus raising the other margin, or even completely turning the bone on itself.

*Treatment.*—*Reduction* can sometimes be accomplished with tolerable facility, or it may be extremely difficult, and sometimes impracticable, the margin of the patella being, it would appear, mechanically fixed in the intercondyloid fossa. The same method of reduction is applicable as for lateral dislocation; relaxation of the muscles by raising the thigh, and pressure on the patella, laterally on both margins, but in opposite directions. Or, forcible flexion of the knee, with rotation of the tibia on the

femur, may succeed; forcible flexion and extension alternately, has also proved successful, or a violent effort by the patient to make these movements. This failing, *subcutaneous section* of the tendon of the quadriceps and of the ligamentum patellæ, has been resorted to. But, in a case related by Mr. B. Cooper, from "Rust's Magazine," in his edition of Sir A. Cooper's work, this proceeding was more than unsuccessful; reduction was still impossible, and extensive suppuration followed, under which the patient sank and died.

(4) Displacement *upwards* can only result from relaxation, or rupture, of the ligamentum patellæ; thus permitting the patella to glide upwards in front of the femur. I have seen this occur once, from forcible flexion of an ankylosed knee-joint.

The *Signs* of such displacement are sufficiently obvious. The patella is drawn upwards, an interval appears below it, or a fold inwards when the leg is placed in an extended position; there is also marked mobility of the leg and proportionate loss of extensor power, the leg hanging down nearly useless and swinging to and fro like a pendulum.

The *Treatment* is the same as for fractured patella, or rupture of the quadriceps tendon. In the case referred to, the power of extension was but partially recovered.

**DISLOCATIONS OF THE KNEE.**—This joint is seldom dislocated; nevertheless, the head of the tibia is liable to undergo dislocation in four principal directions, and in the following order of relative frequency: (1) inwards, (2) outwards, (3) forwards, (4) backwards. The first two dislocations are always incomplete; the latter two may be incomplete or complete. Velpeau has found on record 13 examples of complete dislocation forwards, and 8 backwards.

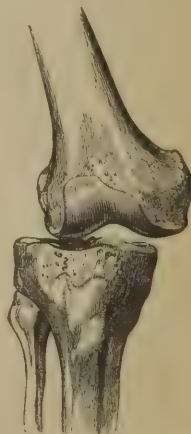
#### *Structural conditions.*

FIG. 204.



—(1) Dislocation of the head of the tibia laterally, *inwards* (Fig. 204); the external condyle of the tibia rests upon the internal condyle of the femur, and the lateral ligaments are more or less completely ruptured. (2) Dislocation laterally, *outwards* (Fig. 205); the internal condyle of the tibia rests upon the external condyle of the femur, and the lateral ligaments are more or less entirely ruptured.

FIG. 205.



(3) Dislocation of the head of the tibia, *forwards*; the head is situated

partially, or entirely, in front of the condyles of the femur, according as the dislocation is incomplete, or complete. The condyles of the femur project, proportionately, backwards in the popliteal space. (Fig. 206.)

(4) Dislocation of the head of the tibia, *backwards*; the head is situated partly upon the posterior half of the condyles of the femur, or it passes up and rests against the posterior aspect of their articulating sur-

faces, according as the dislocation is incomplete or complete. The condyles of the femur project, proportionately, forwards. (Fig. 207.)

FIG. 206.



FIG. 207.



In both the latter dislocations, (3) and (4), it is probable that the ligaments and surrounding structures are similarly injured. Thus, in backward dislocation, the posterior ligament of the joint is torn, the muscles of the ham are stretched, and the popliteal vessels and nerves compressed. With *complete* dislocation, the crucial or inter-articular ligaments are also torn.

*Signs.*—(1) Dislocation laterally, *inwards* or *outwards*, presents oppo-

site appearances. In the one, an unnatural swelling, the inner condyle of the tibia, on the inner aspect of the knee; and another swelling—the external condyle of the femur, on its outer aspect. In the other dislocation or outwards, an unnatural swelling, the outer condyle of the tibia and head of the fibula, is found on the outer aspect of the knee; and another swelling—the internal condyle of the femur, on its inner aspect. In both forms of dislocation, the leg is slightly flexed, or sometimes extended, and twisted, inwards or outwards, towards the side of dislocation, but *not* shortened. Immobility, with inability to use the leg and severe pain, are present, as more or less, in all dislocations. All these signs or symptoms were marked in two lateral dislocations; one of which occurred in my Hospital practice; the other, an outward dislocation, in the case of a lady, well known to me, but who, at the time of the accident, many years since, was under the able care of Mr. Pitt, of Norwich. This case is recorded in the "American Journal of Medical Sciences," vol. xxxi.; and it is also noticed in Hamilton's work. Mr. Pitt's patient quite regained the use of her leg: similar dislocation again occurred about a year afterwards, and was reduced in the act of carrying the patient up-stairs, by her foot accidentally getting entangled in the bannister-rails; it happened again about three months subsequently, when the knee jerked into place spontaneously; and I am happy to say, that excepting a slight weakness of the knee, she now suffers no inconvenience.

(2) Dislocation *forwards* or *backwards*, also presents opposite appearances. In the one, a large swelling, the bulky head of the tibia, projecting in front of the knee, with a deep depression immediately above it and the patella; and another large swelling—the condyles of the femur, in the popliteal region. In the backward dislocation, a large swelling, the bulky head of the tibia, can be felt in the popliteal space; and another large swelling—the condyles of the femur, in front of the knee, with a deep depression below in the situation of the ligamentum patellæ. In both these forms of dislocation, the leg is flexed; in the one case,



slightly back upon the thigh; in the other, extended or bent unnaturally forwards from the line of axis of the femur; shortening also is conspicuous, if either dislocation be *complete*, and varying in extent from one to two inches, or more. Severe pain, and swelling of the limb, may arise from compression of the popliteal nerves and vessels.

*Causes.*—All these dislocations of the knee usually arise in like manner. *Indirect* violence is, perhaps, the most frequent cause; as when the foot is made fast in a hole, and the tibia twisted upon the femur either by the body swinging around upon the knee; or by a fall from some height, or by the individual jumping from a carriage in motion. *Direct* violence, is represented by a blow upon the upper end of the tibia, or upon the lower end of the femur. In one remarkable case, recurring dislocation backwards was produced, as it seemed to me, by *hydrops articuli*. The head of the tibia passed backwards whenever the patient, a woman, bore any weight on her foot and attempted to walk. Similar dislocation, or a tendency thereto, is not an uncommon result of disease of the knee-joint, with retraction of the leg, causing the end of the femur to project forwards in standing or walking.

*Unreduced* dislocation of the worst form, or backwards, may terminate in the recovery of a tolerably useful limb. Three such incomplete dislocations, backwards and unreduced, have been seen by Malgaigne, and neither of the persons thus affected were very greatly maimed in consequence. One walked with crutches after three or four days, and with a cane after about five weeks. Another did not leave his bed under one month, and it was nearly one year before he could lay aside his crutches; but both of these individuals were finally able to walk at least twelve leagues a day. In a similar case seen by Lassus, the patient was confined to bed two years, yet he finally recovered a tolerable use of his limb. Reduction, promptly effected, with sufficient rest of the limb, is followed by sound recovery or very little if any maiming, ultimately. This issue may be hopefully anticipated even when dislocation has occurred repeatedly at distant intervals, as happened in Mr. Pitt's case.

*Treatment.*—Reduction can be accomplished, in the same way, in each form of dislocation of the knee. Flexing the thigh towards the abdomen, and fixing it for counter-extension, extension is then applied to the leg, in the direction of the long axis of the displaced tibia; pressure being made, at the same time, on the ends of the bones in opposite directions, so as to overcome the displacement. Thus, pressure should be applied laterally, on the head of the tibia in particular, inwards or outwards, according to these forms of dislocation; and on the same bone, downwards and backwards, in forward dislocation; or downwards and forwards, in backward dislocation. Splints should be employed to fix the joint, and the appropriate measures also for subduing inflammatory swelling which is often considerable. At the end of two, three, or four weeks, according to circumstances, passive motion may be used gently at intervals, and the joint allowed gradually to resume its functions.

*Internal Derangement of the Knee-Joint*—so named by Hey, who first described it—or subluxation of the knee, sometimes so called. This accident is not uncommon.

The *structural condition* is, probably, a partial dislodgment of one of the semilunar cartilages, owing to a disruption of its ligamentous connexion with the margin of the condyle; the thick margin of the cartilage thus becoming interposed between the articulating surfaces of the

opposed condyles of the femur and tibia; or part of the cartilage slipping before or behind the condyle, the articular surfaces are brought into contact. An analogous condition, in relation to the symptoms thence arising, may also occur; by the interposition, either of a fragment of one of the cartilages, or of an hypertrophied portion of cartilage, or of a false cartilage—a new formation, moving about more or less freely within the joint.

*Symptoms and Causes.*—Sudden inability to use the joint, is felt, which becomes locked, while walking, or by striking the toe against something, or by tripping the foot. Intense and nauseating pain accompanies this sudden locking of the joint, and the person falls to the ground. Any slight twist of the leg, as in bed, by the mere weight of the bedclothes hanging upon the toes, has been known to produce the same effect. In either case, the joint is slightly flexed, and the leg perhaps somewhat rotated. Considerable swelling of the knee rapidly supervenes, and the synovial capsule becomes distended with fluid; in short, subacute synovitis ensues from this injury.

It is very likely to recur, again and again; thus rendering the prognosis unfavourable.

*Treatment.*—This “internal derangement” disappears, in most cases, as easily as it was produced. Flexion, with sudden extension, and slight rotation of the leg, will generally overcome the difficulty, if indeed it should not suddenly right itself. Immediately, the motions of the joint become free and painless, so that the individual can walk about as if nothing had happened. But it is better to place the joint at rest for a while, subdue any synovitis which may have supervened, and then support the knee for some time by means of a knee-cap, to guard against the liability of recurrence.

*Compound Dislocation of the Knee-joint.*—This injury must be regarded as the most perilous of its kind, but fortunately it is of rare occurrence. (Fig. 208.)

*Treatment.*—An attempt to preserve the limb will scarcely ever prove successful; and, excepting in a few cases of more limited damage to the popliteal vessels, nerves, and the integuments, where excision may be sufficient, amputation is the only resource. The injunction originally given by Sir A. Cooper to sacrifice the limb, will generally be unavoidable for the probable preservation of life.

*Congenital Dislocations of the Knee.*—The head of the tibia has been found, at birth, dislocated in various directions; forwards, backwards, inwards, outwards, inwards and backwards, outwards and backwards, and simply rotated inwards. The first-named dislocation is much the most frequent; and the majority of all these congenital dislocations were incomplete. Double dislocations have been found in some instances. Thus, both tibiae were displaced backwards in an infant otherwise deformed, according to Chaussier's observations.

FIG. 208.



**DISLOCATIONS OF THE HEAD OF THE FIBULA.**—The upper end of the fibula may, occasionally, be dislocated *forwards* or *backwards*. Of the former dislocation, Malgaigne has collected three examples, unconnected with any other accident, and not apparently due to any abnormal condition of the ligaments. I have seen another, or fourth, such dislocation, which had remained unreduced. Of backward dislocation, Hamilton enumerates three cases on record.

The *Signs* of these dislocations are very palpable; the projecting head of the bone, immediately under the skin, forwards or backwards, cannot fail to be observed.

The *Cause* is almost necessarily direct violence, as a blow on the head of the fibula. But muscular action is said to have produced two, at least, of the three forward dislocations.

The consequence of any such dislocation may be a laxity of the joint, with mobility of the fibula backwards and forwards upon the tibia. This was the result in one of the backward dislocations recorded by Sanson.

*Treatment.*—Reduction having been effected by pressure, the head of the bone must be kept in place by a compress and bandage.

**DISLOCATION OF THE LOWER END OF THE FIBULA.**—The only instance of simple dislocation is related by Nélaton as having occurred in the practice of M. Gérdy. It was a *backward* dislocation, of thirty-nine days' duration, and caused by the wheel of a carriage passing obliquely across the leg so as to displace the outer malleolus, backwards. The bone was in almost direct contact with the outer margin of the tendo-Achillis, the outer face of the astragalus, abandoned by the fibula, could be plainly felt, and the position of the foot remained unaltered. The patient could walk pretty well, the bone was fixed, and reduction not attempted.

**DISLOCATIONS OF THE ANKLE-JOINT.**—The astragalus in connexion

Fig. 209.



with the foot may be dislocated from the articular ends of the tibia and fibula, in four directions; (1) outwards, (2) inwards, (3) forwards, and (4) backwards. They may be termed dislocations of the foot in these directions. Most of these displacements are accompanied with fracture of the fibula, the tibia, or of both bones. The description of these several forms of dislocation will, I think, be simplified by regarding them, conversely, as relating to the tibia.

*Structural Conditions.*—(1) Dislocation *outwards*. The lower end of the tibia is displaced laterally inwards upon the astragalus (Fig. 209); the outer portion of the articulating surface of the tibia resting upon the inner portion of the upper articulating surface of the astragalus, or it may slide com-



pletely off in the same direction. The foot is turned outwards—everted. The internal lateral ligament is ruptured, or the inner malleolus may be broken, or both; the fibula, also, usually gives way two or three inches above its articulation with the astragalus. (Fig. 210.) Sometimes, in addition to these injuries, there is an oblique fracture of the tibia upwards and outwards from the articulating surface, breaking off that portion of the tibia which corresponds to the inferior tibio-fibular articulation; this fragment remaining connected with the outer malleolus, while the tibia carries inward with it the portion of the fibula above the fracture.

FIG. 210.

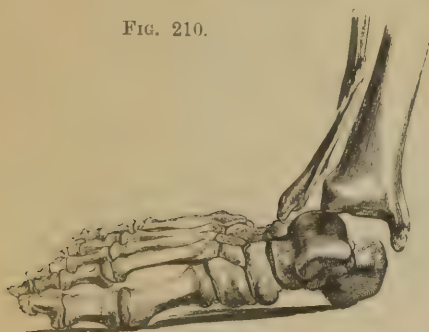


FIG. 211.



(2) Dislocation *inwards*.—The lower end of the tibia, and of the fibula, are displaced laterally outwards; and, perhaps, completely, the articulating surface of the tibia entirely sliding off the upper surface of the astragalus. (Fig. 211.) The inner malleolus is broken off the tibia, but remains attached to the tarsus by the internal lateral ligament; and the external lateral ligament is ruptured, or the outer malleolus may be broken off the fibula, thus making a fracture of both malleoli. The foot is turned inwards—inverted.

(3) Dislocation *backwards*.—The lower end of the tibia is displaced forwards on the astragalus, resting partly on this bone and partly on the scaphoid bone; or completely forward, the tibia then resting on the scaphoid and internal cuneiform bones. (Fig. 212.) The foot in front of the ankle, is shortened. In the latter or complete displacement, especially, the lateral ligaments are more or less completely ruptured; generally, the fibula is fractured but on a level with the articulation; sometimes, the internal malleolus also, and still more rarely, a fracture occurs through the posterior margin of the articular surface of the tibia.

FIG. 212.



(4) Dislocation *forwards*.—This injury happens even more rarely than the preceding, but Malgaigne has collected five instances. The lower end of the tibia is displaced backwards on the astragalus, resting partly on

this bone and partly on the os calcis, behind it. (Fig. 213.) The foot in front of the ankle, is elongated. Dr. R. W. Smith believes that this dislocation is never complete, so that the tibia shall lodge entirely on the os calcis.

FIG. 213.



The lateral ligaments are ruptured, or one or both malleoli are broken.

**SIGNS.**—Dislocation laterally outwards or inwards, presents opposite appearances. *Outward* dislocation is characterized by violent eversion of the foot, its inner margin being directed downwards; the inner malleolus projects prominently under the integuments, and there is a corresponding depression above the

outer malleolus, in the situation of fracture of the fibula. Crepitus may here be detected, and the foot can be moved about pretty freely by the Surgeon, but with great pain. *Inward* dislocation is distinguished by inversion of the foot, its outer margin looking downwards; and the outer malleolus projects strongly under the skin.

Dislocation backwards and forwards, also present opposite appearances. *Backward* dislocation is attended with shortening of the foot in front of the tibia, and depression of the toes; while the heel is elongated, projecting posteriorly, and drawn upwards. The extensor tendons of the toes are sharply defined, and the tendo-Achillis is curved tensely forward. The foot is immovable. These signs are even more marked with *complete* dislocation; the end of the tibia can be distinctly felt projecting forwards, accompanied with an evident depression posteriorly in front of the tendo-Achillis. *Forward* dislocation is characterized by lengthening of the foot in front of the tibia, and elevation of the toes; with corresponding obliteration of the heel, which is in a line with the back of the leg, and depressed downwards. A portion of the articulating surface of the astragalus may be felt in front of the tibia.

**CAUSES.**—*Direct* violence; as a severe twist or wrench of the foot outwards or inwards, represents the ordinary mode of producing either lateral dislocation; the displacement taking place, obviously, in the *opposite* direction to such force. *Indirect* violence; as a fall from a height upon the bottom of the foot may have a similar effect; if the foot have a sufficient inclination to either side, to thus direct the force of the impulse in favour of dislocation to *that* side. forcible flexion or extension, may produce dislocation backwards or forwards, respectively. A fall on the bottom of the foot, the body inclining backwards or forwards, tends also to produce dislocation in the *opposite* direction. But a person jumping out of a carriage in rapid motion and alighting on his feet, is liable to dislocation *in* the direction of the momentum. Thus, from jumping out forwards, the dislocation will be forwards; from jumping out backwards, the dislocation will, probably, be backwards.

**TREATMENT.**—All these dislocations are reduced in like manner. The leg should be flexed to a right angle on the thigh, to relax the conjoined gastrocnemius and soleus muscles; extension is then made from the foot in a line with the long axis of the leg, taking care that the foot inclines midway between flexion and extension of the ankle-joint, and by drawing

with one hand on the back of the foot and the other hand on the heel. Pressure on the end of the tibia, according to the direction of the displacement, will further aid reduction. Lateral splints with foot-pieces may then be applied; but I prefer a McIntyre's trough splint, as affording a more equable support to the whole leg. The swelling around the joint is often considerable; it, however, subsides under the influence of rest and the usual topical applications.

*Compound* Dislocations of the Ankle-joint, are probably the most common of all compound Dislocations. Among the cases recorded by Sir

A. Cooper, 45 were dislocations of this joint; and among Hamilton's cases, 4 were dislocations inwards, and 1 a partial dislocation forwards. The displacements are the same, and arise from the same causes, as in simple dislocation of the ankle; but compound dislocation derives its importance from the size of this joint, and the violence of the injury. (Fig. 214.)



FIG. 214.

*Treatment.*—Preservation of the foot—without any operative interference—proves successful in a far larger proportion of cases than in similar injury of the knee-joint. The wound should be closed and the leg kept at rest on a McIntyre's splint. Protrusion of the tibia with comminution, as often happens in backward dislocation, allows of *excision*, in most cases. But severe contusion or laceration of the soft parts, including injury to the tibial arteries—in addition to compound dislocation of the joint—imperatively demands *primary amputation*. The usual consequences of inflammation, suppuration and sloughing, or gangrene, may render *secondary* amputation necessary, when an attempt to save the foot has failed.

**DISLOCATIONS OF THE ASTRAGALUS.**—This bone is sometimes displaced from under the tibia, and thrown—(1) *forwards*, (2) *outwards*, or (3) *inwards*; the two latter displacements probably being *inclinations* of the bone forwards in either of these directions, thus constituting two lateral dislocations; and occasionally it may be displaced (4) *backwards*. It may also—observes Hamilton—be simply *rotated* on its lateral axis, without much, if any, lateral displacement; and lastly, it is, sometimes, driven *upwards* between the tibia and fibula, tearing away the intermediate ligaments and generally fracturing one or both these bones.

(1. 2. 3) Dislocation *forwards*, and *outwards*, or *inwards*; may be complete or incomplete. *Complete* dislocation of the astragalus represents its detachment from the os calcis and scaphoid bones, and its displacement from under the malleolar arch forwards; the bone lying upon the scaphoid and cuneiform bones. *Incomplete* dislocation signifies the separation of this bone from the scaphoid only, and the ejection of its head on to the external cuneiform or cuboid bones; the body of the astragalus still retaining its connexion with the os calcis, and malleolar arch.

(4) Dislocation *backwards* is a dislodgment of the astragalus on to the os calcis behind the tibia, in the interval between it and the tendo-Achillis.



**SIGNS.**—The projection of the astragalus which can be felt and seen, in each of these directions of dislocation, is alone sufficient to indicate the nature of the injury. (Fig. 215.) The malleoli are nearer the sole of the foot, the tibia having fallen down upon the os calcis; and there may be some flexion or extension of the foot.

FIG. 215.



The *Causes* of astragaloid dislocation resemble those of ankle-joint dislocation. Thus, a fall from a height upon the bottom of the foot, accompanied with violent abduction, adduction, flexion or extension, may determine a dislocation of the astragalus—forwards, inwards, outwards, or backwards; a wrench or twist of the foot, in machinery or in the wheel of a carriage, for example, is another mode of production. A direct blow may also be the cause.

*Unreduced* dislocation of the astragalus is a not uncommon result, reduction being often very difficult and having proved impossible. Recovery of the use of the foot has been attained so far as to enable the person to walk again, but with considerable crippling.

Reduction, on the other hand, even when promptly and easily effected, has been followed by inflammation and gangrene, resulting in death.

**TREATMENT.**—Reduction—when practicable—can be accomplished in the same manner as in dislocations of the ankle. Flexion of the leg to a right angle with the thigh, relaxes the muscles of the calf; and then extension from the foot, with counter-extension from the lower part of the thigh, aided by pressure on the displaced bone, will perhaps replace it. Division of the tendo-Achillis is said to have facilitated reduction in obstinate cases.

The probability of effecting reduction depends very much on the dislocation being *incomplete*; *complete* dislodgment of the bone will be very difficult to overcome. The tibia and os calcis, powerfully drawn together, can hardly be separated to an extent sufficient for the return of the bulky astragalus; itself also bound down by the extensor tendons, in forward dislocation, and by the tendo-Achillis in backward dislocation.

Should reduction have proved impossible, the integument over the projecting astragalus, will probably slough and expose the bone; anticipating this result it is better forthwith to proceed to *excision*, even if the dislocation be *simple*.

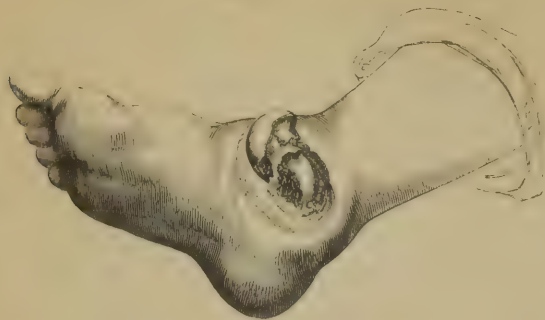
*Compound* Dislocation presents no peculiarity otherwise than the more serious nature of the injury, from exposure of the bone, and as occasioned by more severe violence. (Fig. 216.)

Excision, or amputation, are the only alternatives.

**DISLOCATIONS OF THE OTHER TARSAL BONES.**—Such dislocations are very rare. The *Calcaneum* may, however, be dislocated *outwards* from the astragalus alone; or from the cuboid bone simultaneously, in a direction *outwards* and *upwards*. It has also been found dislocated outwards from the astragalus and inwards upon the cuboid bone.

The *deformity* is sufficiently characteristic. These dislocations have arisen from a fall on the heel.

FIG. 216.



The *Scaphoid* and *Cuboid* bones, together, may be dislocated from the astragalus and calcaneum, *upwards* — the middle tarsal dislocation of Malgaigne. The foot is shortened, and the instep raised; presenting the deformity of club-foot. This injury also has arisen from a fall, but on the ball of the foot.

The *cuboid* bone *alone* may, it is said, be dislocated upwards, inwards, and downwards; but Malgaigne has found no case recorded of this dislocation alone, unaccompanied with that of one or more of the other tarsal bones.

The *scaphoid* bone *alone* has been found dislocated from the cuneiform bones, its connexion with the astragalus remaining undisturbed. The dislocation was compound, yet—after reduction—the wound healed rapidly, and recovery soon became established.

Dislocation of the scaphoid from both the astragalus and cuneiform bones, has occurred in several instances.

The *Cuneiform* bones may be partially dislocated, and without having separated from each other; of which two or three examples are recorded. The *internal* cuneiform bone alone, has been dislocated inwards. Sir A. Cooper saw two instances, in both of which the same appearances were presented; great projection of the bone inwards, with some elevation by the action of the tibialis anticus muscle, and the bone no longer remained in a line with the metatarsal bone of the great toe. A fall from a height produced this dislocation in the one case; and in the other, a fall from a horse, the foot being caught between the horse and the curb-stone. In neither case was the bone reduced; but the subject of the first of these accidents walked with only a little halting.

The *Treatment* of all these dislocations of the Tarsal Bones is the same. Reduction may, possibly, be effected by pressure on the displaced bone. A compress and foot-splint, will then be required to allow the bone to regain its ligamentous connexions.

DISLOCATION OF THE METATARSAL BONES—is, also, very rare. The metatarsal bone of the *great toe* has been dislocated upwards, an instance of which from direct violence was seen by Liston, and reduced. The *inner three* metatarsal bones were dislocated downwards and backwards, in a case recorded by Tufnell, and as resulting from a fall upon the leg

by a horse rolling on its rider; Erichsen also found the *outer* three metatarsal bones dislocated downwards, by the pressure of a "turn-table" on a railway.

The *causes* are usually a fall backwards or forwards, the anterior extremity of the foot being wedged under some resisting body. Various crushing accidents also sometimes occasion these dislocations.

The *treatment* must be conducted on ordinary principles.

Dislocations of the PHALANGEAL BONES of the toes, resemble those of the Fingers, and do not require a separate notice. In a case—related by Sir A. Cooper—all the smaller toes were dislocated forwards; a projection existed at their roots, and the extremity of the metatarsal bones bulged under the first phalanx of the corresponding toes. This displacement had been caused by a fall, from a considerable height, upon the extremities of the toes. Several months had elapsed, and reduction could not be effected. Walking was rendered more tolerable by wearing a piece of hollow cork at the bottom of the inner part of the shoe, to prevent the pressure of the metatarsal bones upon the nerves and blood-vessels.

CONGENITAL DISLOCATIONS OF THE BONES OF THE FOOT.—These Injuries are associated with the various forms of Talipes or Club-foot.

## CHAPTER XXXIV.

### DISEASES OF JOINTS.

UNLIKE Diseases of Bone—wherein the osseous texture or bone proper, the periosteum, and the medullary membrane or endosteum, are *less separately* and distinctly the seat of any particular morbid condition; Diseases of joints relate to the synovial membrane, the articular ends of bone, and the articular cartilages, not to mention the ligaments, as, *severally*, the *seats* of disease; although any such morbid condition, isolated primarily, often spreads to the adjoining structures, secondarily. Thus, the component structures of the joints have each an individuality in relation to Disease; and Diseases of the joints have reference essentially to these component structures.

This pathologically analytical view of joint-diseases—with regard to their seat and origin in joint-structures, is due to Sir B. Brodie; prior to whose observations, both clinical and pathological, Diseases of the joints were confounded under the ambiguous terms, "Arthritis," and "White Swelling."

SYNOVITIS.—INFLAMMATION OF THE SYNOVIAL MEMBRANE.—*Structural Condition.*—An inflamed synovial membrane is more vascular than natural, in the form of crimson spots or diffused redness, and loses its glistening appearance. The synovial secretion is increased in quantity, and thinner. These are the earliest changes. As inflammation proceeds, the membrane acquires a pulpy thickening and opacity, by interstitial exudation, and lymph is effused from its inner surface, giving it a granular or villous appearance, and forming flakes in the synovial fluid, which also accumulates in quantity. Some effusion may even occur in the subserous cellular tissue. This represents the *adhesive* stage of synovitis; an event, however, which rarely supervenes, as the opposed surfaces of the



interior of the synovial Capsule become yet more separated by its increasing distension. Subsequently, pus may be secreted within the capsule, which thus becomes converted into an *abscess*.

*Signs.*—The knee-joint may be taken for example, in regard to Synovitis, as it is more commonly affected than any other joint. Coincident with the earliest stage of inflammation, *pain* is experienced by the patient, and usually referred to a particular spot, perhaps the inner edge of the patella; afterwards extending over the whole articulation. The pain has no specially distinctive character. It is severe in proportion to the depth of the articulation and the unyielding nature of the ligamentous and other surrounding structures. It is also most intense in synovitis of a rheumatic or gouty origin, and as if the joint were compressed by a vice, or being violently torn open. In a period varying from two or three hours to as many days, according to the intensity of the inflammation, *swelling* makes its appearance. The consistence and shape of this synovial swelling are characteristic. At first, fluid and fluctuating, it becomes semi-solid as lymph is effused, and again resumes its original fluidity in the event of suppuration. But the shape of this swelling is even more remarkable. Throughout the course of synovitis, it corresponds to the shape of the synovial capsule; presenting that outline more clearly according to the degree of distension, and as modified by the compression of surrounding ligaments and tendons. The swelling, therefore, varies in form with each articulation, and its relation to the ligaments and tendons. Thus, in the knee, the swelling of synovitis is most conspicuous as a protrusion on either side of the ligamentum patellæ, betwixt it and the lateral ligaments, and rising up above the patella, bulges in a uniform shape as high as the distended capsule may extend. In the elbow, the swelling projects on the posterior aspect of the joint, above the olecranon, and under the extensor muscles of the forearm. In the ankle, it presents on each side, between the lateral ligaments and the anterior tendons. In other joints less superficial, as the shoulder and hip, the swelling of synovitis is less perceptible; in the one being obscured by the cushion of the deltoid muscle; in the other, however, an evident fulness of the groin and sometimes of the nates, can be detected. The wrist-joint is far less frequently subject to synovitis; but here a general fulness and some bulging between the tendons—extensors and flexors, shows a conformity to the rule of characteristic swelling. Heat, and, possibly, redness of the skin around the joint, will also be more or less evident; but these signs are not diagnostic. The attitude of the limb is more or less peculiar, or becomes so. The joint is placed in the position most easy to the patient, and usually becomes semi-flexed. Constitutional febrile disturbance, in some degree, accompanies these local symptoms.

*Causes.*—Exposure to cold, or some occasion of injury, as a blow or fall, may give rise to synovitis. The disease thus occurs in joints which are most superficial and exposed, as the knee and ankle. But these causes are usually backed by some predisposing constitutional condition; especially rheumatism, scrofula, constitutional syphilis, or formerly, by the poisonous administration of mercury. Several joints may then be affected simultaneously. Inflammation of the synovial membranes also ensues, occasionally, from gonorrhœa or purulent ophthalmia. Such synovitis has been incorrectly named “gonorrhœal rheumatism,” although not apparently depending on a rheumatic condition. Gonorrhœal synovitis would be a more correct designation. Arising after gonorrhœa of a few weeks’ duration,

it affects one or more joints. The gonorrhœal discharge may subside, or continue concurrently. Serum rather than lymph is effused into the joint, and the disease terminates without disorganization, in a few weeks. Or, it proceeds, sometimes, to ulceration of the cartilages, and continues for months or a year or two. In one such case, under my care, the knee-joint became firmly ankylosed.

Pyæmia induces a low inflammation of the joints, the special character of which is its abundant sero-purulent effusion, and consequent swelling; unattended by pain, heat and redness, the ordinary symptoms of inflammation. Ulceration of the cartilages ensues if the patient lives long enough.

*Terminations.*—(1) *Resolution* commonly occurs; the pain, swelling, and other symptoms subsiding, and the joint regaining apparently a healthy condition. (2) *Adhesion*, or complete fibrous ankylosis, sometimes results; the fluid portion of the effusion being absorbed, the surfaces of the synovial membrane come together and are partially united by fibrous adhesions; thus leaving the joint much stiffened, in the state of *fibrous ankylosis*. (3) *Fluid* remaining in the synovial capsule; the swelling becomes persistent, with laxity and weakness of the joint; constituting *chronic synovitis*. An extreme degree of this condition has been named *hydrarthrosis* or *hydrops articuli*,—dropsy of the joint. (4) *Suppuration* and *abscess* having occurred; the articular cartilages undergo ulcerative disintegration, and the subjacent bone is liable to become carious—thus ending in total disorganization of the joint; or ankylosis supervenes—sometimes fibrous and stiffly moveable, sometimes bony and fixed. The head of the femur and acetabulum, for example, both denuded of cartilage, may be found to have undergone ankylosis—fibrous, or even osseous. Or, an articular abscess opens, attended with a temporary relief of the symptoms; but a wasting discharge ensues, and the inflammatory fever is exchanged for hectic, under which the patient would ultimately sink from exhaustion, unless the disorganized joint has been removed in time.

*Treatment.*—Absolute *rest* of the joint should be observed, as primarily important; the limb being placed in that *position* which is most easy to the patient, and most convenient in the event of any stiffness remaining. A somewhat flexed position will, generally, best answer this twofold purpose. The limb may be sufficiently steadied by laying it on a soft pillow, which thus partially envelopes the joint; or, a suitable splint should be applied to insure rest. Local depletion by leeches followed by warm fomentations, or cold lotions or irrigation will be appropriate, according to the intensity of the inflammation. *Constitutional* treatment has reference to the inflammatory fever, and any constitutional cause of the inflammation. Hence, saline antimonials with perhaps calomel and opium, may be sufficient to subdue the febrile disturbance and check effusion; or the special treatment for rheumatism, constitutional syphilis, or other such causative condition, may be requisite.

Gonorrhœal synovitis is amenable to the same treatment as that arising from rheumatism. Thus, colchicum and iodide of potassium sometimes prove remedial. But the disease, in most cases, runs its course; or a change of climate from a cold and damp atmosphere to the southern coast, may be followed by a speedy subsidence of the symptoms.

By this plan of treatment, synovitis, in an early stage, will probably terminate by resolution or slight effusion.

*Chronic synovitis* must be treated with a view to the removal of the accumulated effusion, and consequent weakness of the joint. Counter-irritation in the form of blisters should be employed to overcome any persistent inflammation; followed by stimulating embrocations, and pressure to promote absorption. Two or three blisters in succession are certainly preferable to a single blister kept open with savine ointment. The discharge produced by savine ointment soon ceases, and the surface of the skin acquires a mammillated appearance from enlargement of its papillæ. The blisters should not be applied directly over the inflamed joint, but in the neighbourhood. Thus, in the case of the knee, a blister applied on either side of the thigh just above the joint; and with regard to the hip, a blister may be placed on the groin or nates. Of stimulating embrocations, a liniment of turpentine and olive oil, or the iodine paint, are perhaps most efficacious. Pressure can be applied by means of a gutta-percha or pasteboard splint, moulded to the joint; or the joint may be strapped with soap-plaster spread upon leather. The *emplastrum ammoniaci cum hydrargyro* conveniently combines both stimulation and pressure. Injection of the joint with tincture of iodine has been much employed by Velpeau, Jobert, and Bonnet; and it is recommended with more reservation by Erichsen. The tincture is diluted with two or three parts of water. A small trocar is introduced into the joint, a portion of the serous fluid let out, and a corresponding quantity of the iodine solution thrown in, and after being left for a few minutes, is allowed to escape. Inflammation thus produced has, it is said, in no case been followed by serious consequences, but frequently by a complete cure without ankylosis. In a case of hydrarthrosis of the knee, in an old man; Mr. Erichsen drew off about six ounces of thin synovia, and injected a drachm of strong tincture of iodine into the joint. Only slight inflammation ensued, and the disease, of two years' duration, was completely cured. The precautions necessary are; a very chronic, passive, state of effusion, and that no air should enter the joint. Constitutional treatment, by the influence of iodide of potassium and cinchona bark, cascarilla, or other tonics, will aid these local measures.

*Suppuration* and abscess, in the interior of a joint, should be met promptly, by evacuation of the matter. The presence of pus having been first assuredly ascertained by puncturing the joint with a grooved needle; an opening with a bistoury should be made forthwith, freely, and in a dependent situation. This proceeding was, I believe, originally advocated by Mr. Gay, and it has been sanctioned by subsequent experience. Perfect rest of the joint must then be secured by splints, and the limb placed in the position most convenient for use, in the event of ankylosis. A suitable kind of ankylosis having been attained, fibrous or osseous, according to the use of the limb; it will be unnecessary to have recourse to further operative interference, by excision or amputation. Constitutional treatment consists in the tonic medicinal resources and supporting regimen, requisite to sustain the exhaustion of hectic.

CHRONIC RHEUMATIC SYNOVITIS, OR CHRONIC RHEUMATIC ARTHRITIS.—*Structural condition.*—This inflammatory disease involves other joint-textures besides the synovial membrane; but that is the texture first affected. Sir B. Brodie, Cruveilhier, and Dr. R. Adams, alike concur in this view of the structural origin of the above named disease. Hence, the substantive term *synovitis* seems preferable to that of *arthritis*, proposed by Dr. Adams; the etymological signification of the latter term including



inflammation of any or all the structures of a joint (*ἄρθρον*, a joint). That would appear also to be a revival of the old nomenclature, which Sir B. Brodie's pathological investigation, with reference to the *earliest* changes in the various "Diseases of the Joints," was specially designed to correct, and has so advantageously superseded.

Chronic Rheumatic Synovitis differs only from ordinary Chronic Synovitis in certain particulars as to its pathology, and treatment, which are, however, worthy of separate notice. The inflammation of the *synovial membrane* seems to affect the vascular fringe-like processes of this membrane more particularly, which are much developed and injected; the internal surface of the capsule presenting the appearance of a villous mucous membrane. Effusion of fluid within the joint, takes place to a moderate amount, and is eventually absorbed. But the membrane itself remains thickened and fibrous; while osseous deposits frequently form, partly in its substance, principally around the joint, connected with the periosteum and articular ends of the bones. Hence the term *nodosity* of the joints, proposed by Dr. Haygarth, as expressing one of the most distinctive features of chronic rheumatic synovitis or arthritis. The *ligaments* become relaxed; the *articular cartilages* undergo peculiar changes; becoming fibrous and having a yellowish hue, ultimately being destroyed, and presenting patches of ivory-like bony material or porcellanous deposit, white, smooth, and glistening. This acquires even a high polish under the attrition of the surfaces, and linear furrows are formed in the directions of friction by the movements of the joint. Inter-articular ligaments and fibro-cartilages are more or less destroyed and disappear; thus the round ligament in the hip-joint, and the long head of the biceps in the shoulder-joint, are removed by absorption. The sub-cartilaginous *osseous* structure is much condensed, and the whole articular end of the bone enlarged and deformed by the surrounding osseous growths; while the *articular surfaces* become singularly altered in *shape*. Thus, the globular heads of the femur and humerus are flattened and expanded, and their necks shortened; the corresponding articular cavities also being enlarged and shallow. These alterations with the bony buttresses thrown out around the articular ends, have sometimes been mistaken for fracture with bony union, in examining such pathological specimens of the neck of the femur or humerus.

The *Signs* of chronic rheumatic synovitis or arthritis are distinctive;—pain, enlargement and ultimate deformity of the joint, rigidity or stiffness, and a peculiar crackling noise on moving the joint. The pain is not acute, but of an aching character, worse at night, increased by motion, and aggravated by cold and moisture; it is, in short, rheumatic pain. The general health may remain comparatively unaffected.

The *Causes* of this disease always have reference to the constitutional condition of Rheumatism, and sometimes, exposure to cold or injury as an exciting cause. Thus chronic rheumatic synovitis may result from rheumatic fever or from repeated attacks of rheumatism; or in a person predisposed, direct exposure of a joint to cold or some slight injury, as a sprain, may evoke the disease. Many joints are liable to be affected, the disease passing from joint to joint without relieving those originally attacked; or only one joint may be affected. The larger joints, especially the hip, seem to be most frequently attacked in males; the smaller joints, as those of the fingers, in females. But, apart from this relative difference, both sexes would seem to be nearly equally liable to the disease. Age

has no special proclivity; the disease usually occurs after mid-life, but it may also appear in young persons. No social condition is exempt; the poorly fed and hard-worked being prone, the luxurious and indolent, subject to this disease; in the latter class, assuming the character of *rheumatic gout*.

*Course and Terminations.*—Chronic rheumatic synovitis is singularly persistent, evincing little tendency to subsidence, or termination by resolution. The irregular enlargement and deformity of the joints, with the weakened state of the ligamentous structures, and altered shape of the articular surfaces, predispose to partial dislocations; leaving the patient stiffened and crippled in his movements, and ultimately reduce him to a helpless condition. Loose cartilages, moreover, are apt to form in the joints. Suppuration rarely, if ever, occurs; the disease—apart from any temporary effusion of fluid—is essentially a *dry* disease of the joints. Ankylosis also is a rare event; although the increasing articular rigidity, and wasting of the diseased muscles, have an equivalent result.

*Treatment.*—*Preventive* measures, in the early stage of this disease, may succeed in averting its destructive consequences; but any curative measures, for the removal of the osseous deposits or out-growths, and restoration of the disorganized state of the joints—in respect to ligaments, synovial membrane and cartilages, will have scarcely any avail. *Local* treatment—in the early stage—is that of synovitis. Rest of the joint, and slight topical depletion by a few leeches, may now prove efficacious. But, as the symptoms of inflammation subside, leaving some structural results—in thickening of the synovial membrane and effusion within the joint—counter-irritation, by means of blisters, or iodine paint, will become advantageous. Stimulant embrocations and friction, as by shampooing or local douches, and motion, may then succeed in recovering the use of the joints. The *constitutional* treatment should be that of rheumatism. In the early stage, bicarbonate of potash, in large doses, with wine of colchicum, may arrest the progress of the disease. Subsequently, iodide of potassium and guaiacum seem to have more controlling influence. Free action of the skin must be promoted by sudorific medicines, as Dover's powder and hot air-baths; while a rigorous attention to diet will be indispensable when the disease has a *gouty* character, with dyspeptic symptoms, denoting a constitutional origin of that kind. Mineral waters, coupled with a due observance of dietetic precautions, sometimes prove singularly beneficial in rendering joints supple and restoring the general health, at least for a time. The waters of Bath or Buxton in this country, Vichy, Wiesbaden, Carlsbad, Ems or Aix-la-Chapelle on the Continent, are thus hopeful resorts for the victims of chronic rheumatic synovitis.

SCROFULOUS SYNOVITIS.—*Structural Condition.*—A pulpy or gelatinous degeneration of the synovial membrane, resulting from inflammation of a chronic character, modified by a scrofulous constitutional condition.

The synovial membrane, in this state, is thickened, and converted into a soft yellowish or light brown gelatinous material; more vascular also than the healthy membrane. This change may be partial in its extent, affecting only the membrane reflected over the ligaments, or over the cartilages. Sir B. Brodie, who first described this disease, relates such cases as shown by dissection. The articular cavity becomes diminished as the thickening upon the *inner* surface of the membrane encroaches on the joint; and, this extension proceeding most freely in the loose synovial folds which surround the cartilages, they are often concealed by the new

formation. A similar pulpy material forms in the areolar texture around the outer surface of the membrane, which thus becomes infiltrated and condensed. This gelatinous material—according to Mr. Barwell—results from a failure in the process of development of the products of inflammation; in acute and healthy synovitis, a fibrous or areolar tissue being produced; whereas in scrofulous inflammation, development does not advance beyond the first form of crude cell-structure. Many intermediate gradations, however, may be found between these two conditions.

The knee-joint is most commonly affected.

*Signs, and Diagnosis.*—In an early stage, a sense of stiffness of the joint is experienced and tumefaction appears, beginning almost imperceptibly, but slowly and gradually increasing; with absence of pain, even on moving the joint. These early symptoms are not very characteristic. In a more advanced stage, a very considerable enlargement is presented, generally of an irregular shape, colourless and elastic, without any distinct fluctuation. This disease most resembles scrofulous caries of the articular ends of the bone in the joint affected. But the *swelling* is diagnostic, in its being more obviously referable to the synovial membrane than to the end of either bone. From cancerous disease of either articular end of bone, the same feature of distinction may be available for diagnosis; while the whiteness of the skin contrasts with the reddish or purplish discoloration which sooner or later supervenes in malignant disease, as the skin becomes involved. The lymphatic glands also are not contaminated.

*Course and Terminations.*—As the disease progresses, the cartilages undergo *ulceration* in spots; though these spots are not, necessarily, at first, in direct relation with the pulpy synovial membrane. The changes which ensue are fully described in tracing the Ulceration of Articular Cartilages. Abscess forms within the joint, or in the substance of the swollen membrane; and making its way to the surface, opens by various sinuous apertures. Hectic supervenes.

Occasionally, the disease subsides by apparently a retrograde course of restoration. The gelatinous growth is directed inwards towards the articular cavity, which it tends to fill up; while the material itself becoming more fibrous, and contracting, still further diminishes the cavity. *Anchylosis* of the osseous surfaces completes this process of recovery. Rarely, the synovial membrane itself is restored to a healthy state; *absorption* taking place, and the articulation remaining structurally sound.

*Treatment.*—Remedial measures must have regard to the constitutional condition, and hence the treatment of Scrofula is here appropriate. Local treatment consists, in absolute rest of the joint, and the observance of a suitable position in the event of ankylosis. Counter-irritation should be applied, cautiously. The actual cautery is, however, strongly recommended by Mr. Barwell, when enlargement is proceeding without any notable inflammation. The iron should be white hot, and applied in lines, about an eighth of an inch broad and three inches long, parallel to the axis of the limb. Four such lines are recommended for the knee, two on each side of the patella, at least an inch apart; dry lint being then applied. This proceeding resembles the “firing” of a joint, as practised in veterinary surgery. The advantage of counter-irritation, by means of the actual cautery and thus applied, is said to be not only its derivative effect, but the pressure which ensues from the contracting



cicatrices. Scott's dressing may be used as a means of counter-irritation, and the plaster affords more support, when the swelling is reduced to a passive state. Friction and gradual motion will then finish off the disease, and restore the use of the joint.

Ulceration of the articular cartilages, with abscess, and destruction of the joint, necessitate the removal of the diseased part, either by excision or amputation. The latter operation may be sometimes imperative, owing to the constitutional exhaustion rather than the extent of the disease. Loss of limb will then be alternative to the loss of life; the patient, otherwise, inevitably sinking under prolonged hectic.

SCROFULOUS DISEASE OF THE JOINTS, or scrofulous inflammation and *caries* of the cancellated structure of the articular ends of Bone.—*Structural condition.*—The alterations of the cancellous structure in this state of disease, are fully described in DISEASES OF BONE. The changes alluded to may be summed up as inflammation and consequent caries; differing only from ordinary inflammation of bone in the nature of the products associated with the disintegrative transformation. At first, the cancellous structure is simply more vascular than natural, then it becomes softened, and porous; while the cancelli are filled with a reddish gelatinous fluid, and ultimately an opaque, friable, tuberculous matter. Caries appears frequently in separate points of the cancellous tissue, which gradually extending, coalesce.

This disease is commonly situated in the articular ends of the long bones; particularly, the head of the femur, in scrofulous disease of the hip-joint; in the head of the tibia or lower articular end of the femur, in similar disease of the knee-joint; in the bones of the tarsus; in those of the carpus; in connexion with the elbow or shoulder joints, occasionally; and not unfrequently in the cancellous tissue of the bodies of the dorsal or lumbar vertebrae. Nor do these situations exhaust the list of bones liable to be affected by scrofulous caries.

*Signs.*—Scrofulous caries of the *knee-joint* may be taken as typical of the *general* symptoms. The disease approaches very insidiously, being preceded by little or no pain. Some inability to use the joint—a limping lameness in walking—first attracts notice. A child for example—the disease occurring commonly before puberty—drags his foot after him in walking. Weeks or perhaps months elapse ere pain is complained of; and then only a trifling pain, intermittent, but fixed, and aggravated by any movement of the joint, or especially on percussion of the bone below, and of the foot in disease of the knee-joint. This pain increases as the disease progresses. At length a swelling of peculiar character forms around the joint, arising from infiltration of the cellular texture with serum and lymph. A puffy, elastic swelling is thus produced, which assumes a *globular* shape, while the skin retains its white colour, constituting the “white swelling,” formerly recognised in Surgical works. This swelling becomes more conspicuous and apparently larger than it really is, owing to gradual wasting of the muscles above and below the diseased joint. Scrofulous enlargement of the knee-joint, for example, thus *differs* notably in its characters from the swelling of Synovitis. The absence of pain in the first instance, and for a considerable period, is also diagnostic. In either disease, the limb becomes somewhat flexed, from muscular action prevailing in that direction. The general health remains comparatively undisturbed up to this period.

*Course and Terminations.*—Scrofulous caries of a joint may sub-

side, leaving only some œdematous swelling and stiffness of the joint. Or, the disease progresses, both to the surface, and the interior of the joint.

In the one direction, as the disease advances, the periosteum becomes detached, *suppuration* takes place *around* the joint, and sinus-openings form, leading down to worm-eaten carious bone, and giving vent to a foul discharge. The textures are undermined and traversed by sinuses

FIG. 217.



in various tortuous ways, according to the anatomical relations of the joint. (Fig. 217.) Towards the *joint*, as caries extends, the nutrition of the cartilages, depending on the osteal vessels, becomes impaired. Their attachment to the bone is loosened, and they acquire a fibrous character. *Ulceration* commences, usually, on the deep or osseous surface of the cartilages; as a disintegration equivalent to the carious state of the bone. Portions of cartilage may be detached and lie loose within the joint. Sometimes, the ulceration assumes a peculiar form, which has been named "spotted ulceration;"

there being several pits containing a curdy matter in the articular surfaces, and which correspond to pits in the bone, while the intervening portions of cartilage remain unaltered.

Ulceration of the articular cartilage is announced by painful startings of the limb, occurring particularly at night. Synovitis speedily supervenes, and the formation of matter *within* the joint. The opposite articular cartilage becomes affected and the bone exposed. The two sensitive osseous surfaces meeting together and being subject to attrition and pressure by spasmodic action of the muscles, the starting pains are much aggravated. The ligaments share this destructive progress of the disease, and give way; the *abscess* within the joint bursts through the synovial membrane, and at length finds its way to the surface, with sinuous openings around the joint. The head of the bone, altered in size and shape, and no longer restrained by ligamentous connexions, undergoes *dislocation*; in whatever direction the disease may facilitate displacement, and subject to the action of the muscles.

The joint has thus become irreparably disorganized; but *ankylosis* may take place without dislocation, or an imperfect *joint* form after dislocation, the bone remaining in its new locality. Either of these reparative terminations, in the course of nature, are rare.

Constitutional disturbance of the most severe kind accompanies the destructive course of this disease; and the patient probably sinks ultimately from long-continued pain and sleeplessness, purulent discharge and the night sweats of hectic.

The concurrence of scrofulous disease in other organs, than the joints, must not be overlooked in our *prognosis*. Thus, the lungs or mesenteric glands may be affected with tubercular deposit; or tubercular meningitis ensue, with effusion into the ventricles of the brain. And

the social state of the individual should be taken into account; scrofulous disease arising and progressing far more readily in the poor and needy, than in the affluent classes of society.

*Treatment.*—Local appliances are of subordinate importance to constitutional treatment, yet they are co-operative in arresting scrofulous caries and the reparation of its destructive consequences.

In the first place, absolute *rest* of the limb is an essential condition throughout this disease; in the earliest stage to arrest its progress, subsequently to relieve pain and induce ankylosis. Due regard should also be had to the *position* most favourable for the future use of the limb, in the event of this issue. Such rest, and position, can only be secured by means of a suitable splint. A leather or gutta-percha splint moulded to the joint answers best, generally. But the splint must be of sufficient length to fix the limb entirely, and check any contraction of the muscles which would affect the joint. Thus, in scrofulous disease of the hip-joint, a gutta-percha splint should be applied so as to embrace one side of the pelvis and two-thirds of the circumference of the thigh, and extend from the short ribs to below the knee. The limb should be in a line with the trunk, or bent only *slightly* forwards. For the knee-joint, two lateral splints are preferable; supporting two-thirds of its circumference, and extending from the middle of the thigh to the middle of the leg. A *slightly* flexed position will be the most convenient in the event of ankylosis. For the ankle, also, two lateral splints may be made to include the lower part of the leg and the sole of the foot; the patient being allowed to walk about with the knee supported by a wooden leg. Disease of the bones of the foot, will require the support of a splint moulded to the sole, and turned round the inner and outer side. Over this, a large cloth boot may be worn, whereby the patient can walk about without injury to the diseased joints. In the upper extremity, scrofulous disease of the joints must be treated on a similar principle as to rest, and position. For the shoulder, a splint should be moulded to the joint, and extend down the arm to the elbow; the forearm being suspended in a sling from the neck. A diseased elbow-joint is best supported by lateral splints; the wrist by a splint on its palmar surface, extending upwards to near the elbow and downwards to the tips of the fingers, and doubled at its margins over the sides of the hand and forearm.

In an *advanced* stage of the disease, when painful startings of the limb, and a tendency to dislocation have supervened; it becomes advisable to slightly separate the diseased *articular* surfaces, and counteract muscular contraction. Some *extending* force, moderate but constant in its operation, may be advantageously resorted to. For the hip-joint, Liston's long splint, interrupted, will accomplish this purpose. The knee-joint is, perhaps, best managed by a pulley sling-apparatus which encloses the limb in a canvas-trough; while slight extension is maintained by the inclined direction of the pulleys. This apparatus—applicable also to fracture of the thigh or leg—gives great ease and comfort in advanced disease of the knee-joint. Other joints may be subjected to contrivances which seem most effectual.

Lastly, whatever be the *termination* of scrofulous caries, a *starched bandage* is an exceedingly useful support. If the disease be arrested, leaving only some oedematous swelling of the joint; the uniform pressure of this support will aid in reducing the swelling, and the patient



can get about on crutches—supposing the lower limb to be affected—with the benefit of air and exercise. If ankylosis have ensued, or a new joint as the result of dislocation; the support of a starched bandage will be equally advantageous. The period of time necessary for the use of some support to the seat of disease is always considerable; many months, possibly years.

Other local treatment—from first to last—may be regarded as comparatively unimportant. Scrofulous disease of a joint cannot be arrested by any depletory measures, and in proportion as they reduce the general health such measures are positively injurious. *Local blood-letting*, by a few leeches, may sometimes prove advantageous in the incipient or vascular stage of the disease. But the repeated loss of blood would be injurious. *Counter-irritation*, by blisters, setons, &c., has an equally restricted applicability. The discharge and pain they occasion, more than counterbalance any good resulting from their *derivative* action, especially in children. If the disease subsides, with œdematous swelling; *stimulating* applications have some beneficial influence. Hence, embrocations, iodine paint, and douches of sea-water, are now useful. Pressure also—as by a starched bandage, or pressure with stimulation—by Scott's strapping, may be applied with advantage.

*Abscess* having formed—as the disease progresses; a free and dependent opening should be made in time to prevent burrowing of the matter. The starched bandage can still be used, with a trap-opening opposite the abscess, for the convenience of dressing and cleanliness.

The local treatment of scrofulous caries of a joint, thus generally resembles that of synovitis; in respect to rest and position of the joint, topical applications, and the treatment of abscess. But the *constitutional* treatment of this disease is precisely that of Scrofula. This treatment consists in a course of tonics, especially the preparations of iron and quinine, a nutritious diet, including cod-liver oil, pure air, daily exercise, and sea-bathing. The administration of medicinal tonics should be varied from time to time, and with occasional intermissions. For children, the *vinum ferri* seems preferable, and after a while the syrup of the iodide of iron may be given in exchange; these and other simple preparations of iron being continued for three or four weeks, and then omitted for a week or ten days. But this course of treatment must be extended over a considerable period, probably two or three years.

ULCERATION OF ARTICULAR CARTILAGES.—*Structural condition*.—The articular cartilages, when fully developed, and in a healthy state, are destitute of blood-vessels (and nerves). Nutrition is effected—as in the cornea—by imbibition; the nutrient matter being drawn from the blood-vessels of the subjacent bone and vascular fringe of the synovial membrane around the circumference of the cartilage. As the result of inflammation—according to the observations of Sir B. Brodie, Mayo, and Liston—blood-vessels extend into the cartilages from the subjacent bone; just as they form in extravasated lymph. Hence the nutrition of articular cartilages, in this state, depends on a supply of nutritive matter, directly from the vessels, as in other vascular textures. But this question of the *vascularity* or *non-vascularity* of cartilage—with regard to the more or less direct supply of blood, has nothing whatever to do with the nutritive process itself as pertaining to the elemental structures, in health and disease. In regard to ulceration of the articular cartilages, the researches of Goodsir and Redfern, more particularly, have shown, that it represents

a vital alteration in the cartilaginous structure itself; and that the influence of the neighbouring blood-vessels is only indirect or secondary.

As consequent on inflammation of the *synovial membrane*—synovitis, or of *bone*—ostitis, ulceration of articular cartilage may be named *inflammatory* ulceration, or *secondary*, in its relation to the original disease. Similar ulceration may also occur as an original disease of the cartilage, and is hence named *primary* ulceration. But this state would seem to be, usually, a degeneration. Degeneration precedes inflammatory ulceration when the disease originates in *bone*, and extends to the cartilage as a secondary affection.

Ulceration may *begin*, either on the *free surface* of articular cartilage, or on its *attached surface*; and at its *margin*, where the synovial membrane is reflected over it, or in the *substance* of the cartilage. In the hip, it may commence close to the attachment of the round ligament; or in the knee, adjoining the crucial ligaments.

Forming shallow excavations, these assume the appearance of grooves, at a greater or less distance from the margin and frequently in the central parts of the cartilage. Nearly the whole cartilage may disappear, leaving only a few isolated reddened patches.

Inflammatory ulceration—consequent on *synovitis*, presents the following alterations, on the free surface of the cartilage. The colour of the cartilage is altered in spots; which either rapidly become holes, as if cut out with a chisel, or the spots assume a fibrous aspect, and becoming excavated, form pits with fringed margins. Thus, the cartilage may be extensively destroyed, and the bone laid bare. Or, and especially in serofulous synovitis, a thick vascular membrane forms, which passes from the diseased synovial membrane over the cartilage. The cartilage—as Mr. Barwell describes it—slowly undergoes transformation into a kind of granulation, between which and a similar material growing from the synovial membrane, adhesions ensue, resulting in absolute continuity. When ulceration of the cartilage has extended deeply, the bone becomes involved, and the cancellous tissue acquires undue vascularity. The articular lamella of bone—a layer of calcified cartilage—crumbles or breaks up in masses, carrying with it portions of cartilage; and the granulations springing from the exposed cancellous tissue unite with those of the synovial membrane.

Ulceration consequent on disease of the *subjacent bone*, consists—according to Mr. Barwell—in degeneration, followed usually by inflammatory ulceration. A portion of the cartilage, losing its nutrient supply, degenerates or perishes, and is detached with its articular lamella from the inflamed surface of bone; whilst the surrounding portions of cartilage undergo the changes described as occurring in ulceration from synovitis.

The *minute* changes in this process of ulceration relate both to the cartilage-corpuscles and the inter-cellular or hyaline substance. The corpuscles enlarge, with an endogenous development of cell-structures, and bursting, discharge their contents into cavities in the tissue itself, or upon the free surface, mingling with the organic matters contained within the joint, and probably forming pus. This endogenous productiveness is greater, the nearer to the seat or focus of disease. There, instead of two or three nucleated cells, the corpuscles may contain an almost indefinite number of younger cells, resembling pus-globules. The inter-cellular or hyaline substance undergoes disintegration, or in more chronic ulceration, it becomes split into bands or fibres of varying size, in the midst of

which, sometimes, are found gelatinous masses; the changed contents of the cartilage corpuscles as Dr. Redfern supposes.

These changes occur more or less rapidly in proportion to the activity of the disease; thus representing the *acute* and *chronic* varieties of ulceration. In one case, the patient having died after venesection, Mr. Lawrence believed that complete destruction of the articular cartilages of the femur and tibia took place in four days. Chronic ulceration may progress very slowly, especially when of rheumatic origin.

*Signs and Diagnosis.*—(1) *Secondary* ulceration of the articular cartilages is announced by the *starting pains* adverted to in connexion with the *progress* of synovitis and scrofulous caries; and the articular disease is preceded by the symptoms of one or other of these diseases. (2) *Primary* ulceration, of an inflammatory character, presents certain special and distinctive signs, as compared with synovitis or caries. *Pain*, fixed and intense, is the earliest symptom, and coincident with the *commencement* of the disease. This pain is aggravated by movement of the joint or friction—rather than by percussion of the bones—and accompanied with startings of the limb, as muscular spasms supervene. In the course of weeks or months, slight *swelling* arises, corresponding in shape to the margin of the affected cartilages, and produced by serous effusion into the cellular texture externally. Abscess, within the joint, follows.

*Repair*—after ulceration of articular cartilage—takes place in different ways. Extensive destruction of the opposed cartilages, with exposure of the cancellous bone; may be followed by the formation of granulation-tissue, uniting the osseous surfaces, and resulting in ankylosis. Ulceration affecting the cartilage to a considerable depth is sometimes repaired—as Redfern describes—by the formation of a fibro-nucleated membrane from the substance of the cartilage, without the occurrence of any new exudation. Occasionally, a patch of ivory-deposit or porcelainous-encrustation, occupies the place of a portion of cartilage; or a scar alone marks the seat of a former ulcer.

*Treatment.*—The *local* treatment is the same as for other inflammatory diseases of the joints. Absolute rest, and position of the joint, must be observed, and for a considerable period. Counter-irritation, by blisters, issues, or caustic potash, may be applied more advantageously than in scrofulous caries. Abscess must be opened forthwith, and ankylosis induced, as the only favourable termination in this advanced state of the disease. Excision or amputation are ulterior resources, which will be considered with reference to Diseases of the Joints, specially. (Chapter XXXVII.) The *constitutional* treatment resembles that for rheumatism affecting the joints. Mercury, in the form of calomel, the bichloride, or blue-pill, combined with opium, should be administered, and pushed to slight salivation. Mercurial inunction must be resorted to, if the internal administration disagree. This may be followed by iodide of potassium and sarsaparilla. But subsidence of the joint-symptoms will soon declare whether the articulation itself is preserved, or ankylosis be inevitable.

*ANCHYLOSIS, OR STIFF JOINT.*—*Structural Conditions.*—Two states of ankylosis are recognised; the *fibrous* or incomplete; and the *osseous* or complete. Both signify the junction or union of the *articular* surfaces of the *bones*, thus presupposing the partial or complete removal of the articular cartilages; unless occasionally, in fibrous ankylosis, where bands of false membrane may be thrown across the synovial capsule, forming adhesions, with some stiffness of the joint. Either condition of



anhylosis may be *extracapsular*; the fibrous consisting of a thickened and indurated state of the ligamentous capsule, with adhesions around the joint; and osseous anhylosis externally, being the formation of new bone around the joint.

(1) *Fibrous anhylosis* is liable to happen to any joint; and the shortened and contracted state of the muscles acting on the joint gives an apparent firmness to the anhylosis, beyond that due to the joint-condition.

(2) *Osseous anhylosis* occurs most commonly in the hip, knee (Fig. 218), or elbow; the articular surfaces seeming to be fused together, as seen more clearly on a vertical section of the bones.

Both states of anhylosis are attended with a proportionate loss of mobility in the joint; the fibrous allows of some degree of motion, more so, perhaps, under chloroform; the osseous presents a perfectly rigid and immovable joint.

Both anhyloses are also accompanied with more or less *deformity* of the *limb*, arising from mal-position of the bones obediently to muscular contraction; unless the anhylosis has resulted under proper and effectual surgical supervision.

The *Causes* of anhylosis have reference to inflammatory diseases of the joints; synovitis, caries, and primary ulceration of the articular cartilages, as already described. Destruction of the cartilages thence ensuing, may be succeeded by *reparation*, in the form of anhylosis. The fibrous state represents the incomplete result of reparation; the osseous state, its completion, by the transformation of the fibrous matrix into bone.

*Treatment*.—*Preventive* measures consist in the prompt and efficient treatment of the diseases leading to anhylosis; while the precaution should also be taken of securing the limb in such *position* as shall be most useful in the event of this result.

*Remedial* treatment consists, in restoring, if possible, the mobility of the joint, and correcting any deformity of the limb. Or the latter may be the main object in view.

*Fibrous anhylosis*—admitting of some motion in the joint—commonly yields to passive motion, from time to time; thus gradually regaining the use of the joint. Firmer union will, probably, have to be overcome by forcible *flexion* and *extension*, under the influence of chloroform. The joint yields with a creaking cleavage and successive snaps, which are both heard and felt. Any resisting tendons may be divided subcutaneously, tenotomy completing the cure. The knee or elbow-joints, for example, can thus be restored to a fair degree of mobility, and the limb brought to a good position. When these manipulative or operative procedures have failed; if then the fibrous anhylosis be incompatible with a good use of

FIG. 218.\*



\* Bony Ankylosis of Knee-joint, with extreme mal-position—tibia forward at right angle with femur. (A. Cooper.)

the limb, as in the case of such ankylosis of the knee-joint; *excision* of the joint may advantageously be resorted to; and the more so, in proportion to *mal-position* of the limb.

*Osseous ankylosis* cannot be overcome by any justifiable force of extension. If, therefore, the limb be comparatively useless, as in the case of the elbow-joint, *excision* must be had recourse to. The removal of a wedge-shaped portion of bone above or below in connexion with the ankylosed joint, may be necessary to correct an angular deformity of the limb in the case of the knee-joint. In any case of osseous ankylosis, the propriety of excision will also depend on the *mal-position* of the limb which may accompany the ankylosis. *Amputation* will be warrantable only in the extreme case of a useless limb, and which cannot be made tolerably serviceable by excision.

**LOOSE CARTILAGES IN JOINTS.**—Small moveable bodies occasionally form within a joint, and which may be quite free, or attached by narrow peduncles to the walls of the articular cavity. One such body sometimes exists, but not uncommonly two or three, and possibly, many. In the left knee of a woman who died of apoplexy, Morgagni found twenty-five smooth and polished globular bodies. Varying in size from a barley-corn to a chestnut, they are roundish or flattened, elongated or tuberos. In consistence, colour and structure, these bodies may be soft and of a yellowish colour, like little masses of fibrine; or hard, whitish and glistening, consisting of cartilage or fibro-cartilage; or converted into bone. Neither the term "cartilage" nor "loose," is, therefore, universally applicable.

Any joint possibly, may be the seat of these bodies; but they occur usually in the knee, and less frequently in the elbow, shoulder, or lower jaw.

They seem to *arise* from the vascular processes of the synovial membrane, as out-growths of that membrane, projecting into the joint. They remain connected, or become detached, and are liable to undergo the changes of appearance and structure, above described. These cartilaginous bodies form most frequently as the result of chronic rheumatic synovitis; and more often in adults than at an earlier period of life. Other modes of origin seem probable in some cases. Thus, the fibrinous concretions may, perhaps, represent exudations, or precipitations from the synovia. Portions of bone becoming detached from the articular surfaces, or resulting from ossific deposit, give rise to similar symptoms.

**Symptoms.**—It will be readily supposed that any such foreign body getting nipped in between the articular surfaces, must occasion some remarkable symptoms. Hence, an attached cartilaginous body may remain quiescent; a detached, or entirely loose cartilage, moving about in the synovial capsule, is more apt to slip in between the bones. Up to this time the patient may have experienced occasional twinges, as if of rheumatic character; but now a sudden, intense, and sickening pain seizes him; and the joint becoming instantly locked, the hitching or fixed inability to move the limb, may throw him to the ground in the act of progression. Sudden dislodgment of the intervening cartilage is equally apt to occur, whereby the joint is immediately restored to its original state of painless mobility; leaving only perhaps a little temporary effusion. These symptoms having recurred at intervals, on the slightest movement, and sometimes during sleep; the sufferer seeks relief. On careful examination, a foreign body can usually be found, and by palpation brought

perhaps to a stand-still at the edge of the patella—in the knee-joint, and there made to bulge under the skin; but the little smooth cartilage easily slips away from under the finger and again disappears.

Ultimately, the joint itself sometimes becomes diseased; prolonged irritation inducing synovitis with relaxation of the ligaments, which are loosened also by having been stretched by the repeated interposition of the cartilage between the articular surfaces.

*Treatment.*—Recurrence of the attacks of pain may be prevented by limiting the motions of the joint; thus fixing the loose cartilage, temporarily, or perchance permanently. Hence, an elastic bandage or knee-cap should be constantly worn. Often the relief afforded is such that no further interference becomes requisite.

*Removal* of the foreign body, is the only other resource; but this should never be lightly entertained, considering the risk to the joint and even to life, contingent on the operation of extraction. It is justifiable only when the cartilaginous body is loose, and freely moveable, of some size, and apparently single. Taking a favourable opportunity—after the pain and irritation of an attack have subsided—this operation may be performed, in either of three ways. It is more difficult than would appear to one who has not done it. The cartilage must first be carefully fixed, in a steady spot, with the forefinger and thumb. In the knee, it may be made to project on one side of the patella. The skin is then to be drawn to one side, and an incision made *directly* down upon the cartilage, which is thence allowed to *escape*. On relaxing the skin, the valvular aperture is at once closed with a strip of plaster, and the limb should be kept at rest until any symptoms of synovitis have subsided.

Another mode of operation, consists in introducing a tenotomy knife *slantingly* underneath the skin and dividing the synovial capsule upon the fixed cartilaginous body; then squeezing it through the synovial aperture into the external cellular texture, where it is allowed to *remain*, the integumental aperture is closed with a strip of plaster. If the cartilage should not become absorbed, it is extracted from its bed by a *subcutaneous* incision, when the synovial aperture has healed, after the lapse of some days.

Both these methods of operation are hazardous; but the subcutaneous one is less so than the immediate mode of extraction, as would appear from a large number of cases the results of which were compared by M. Larrey. In 167 cases of removal of loose cartilages by operation; 121 were cases of the direct operation, and 98 were successful, 5 doubtful, and 28 died; whilst of 39 subcutaneous operations, 19 were successful, 15 failed, and 5 died.

A modification of the subcutaneous operation has been practised by Mr. Square of Plymouth; and by which Mr. Erichsen states that he has successfully removed in succession five loose cartilages from one knee. The capsule having been divided subcutaneously over the fixed cartilage, it is pressed *into*—not through—the synovial aperture, and retained there by a compress and strips of plaster. Adhesion speedily ensues, followed by absorption of the cartilage.

Mr. Syme recommends yet another method, by which, he says, he generally succeeds without risk. It consists in “making a free subcutaneous incision through the synovial membrane and cartilage, and applying a blister over the part where it is retained.”

TUMOURS CONNECTED WITH JOINTS.—*Cancer* of the *Articular* ends of



Bone is sufficiently described in connexion with Cancer of Bone generally. "In *cartilage*" observes Virchow in his Cellular Pathology, "malignant affections are so rare, that it is usually assumed to be altogether insusceptible of them." The *synovial membranes* are equally indisposed to cancerous disease. Sir B. Brodie states, that he had "no reason to believe that any truly malignant disease ever has its origin in the synovial membrane."

For other Morbid Growths in the articular ends of Bone—see TUMOURS OF BONE.

NEURALGIA OF JOINTS is specially important in relation to the *diagnosis* from structural disease—see affections of the NERVES.

## CHAPTER XXXV.

### DISEASES OF PARTICULAR JOINTS.

DISEASES OF THE HIP-JOINT.—The hip-joint is liable to the same inflammatory diseases as other joints, affecting its component structures; synovitis, scrofulous caries, and ulceration of the articular cartilages. The second-named disease presents characters worthy of a separate description.

SCROFULOUS DISEASE OF THE HIP, OR MORBUS COXARIUS.—*Structural condition*.—This disease commences in the *cancellous tissue* of the head of the *femur*, or of the *acetabulum*; possibly, in both bones simultaneously. It may also commence in the synovial membrane, as scrofulous synovitis; or, it is said, in the round ligament. Hence, the name, *scrofulous disease* of the hip, as a general term including these different *seats of origin*.

In scrofulous caries of the hip, the cancellous tissue undergoes the structural alterations described in connexion with this disease of Bone; briefly, increased vascularity, softening, deposition of a reddish fluid in the enlarged cancelli, followed by a yellowish opake tubercular matter.

*Subsequent structural alterations* are as follow:—The *articular cartilages* become involved and disappear, more or less completely; and abscess forms within the cavity of the joint. The affected portions of bone become remarkably changed in shape and size. The *head* of the femur—bared perhaps of cartilage and the open cancellous tissue exposed—is flattened and expanded, mushroom like in form on the neck of the bone; and the *neck* itself sharing in the disease, may be so reduced, as to leave nothing more than a slight nodular vestige, if any remnant, of the diseased bone projecting from the great trochanter. This portion of the bone, and the adjoining portion of the shaft, are not unfrequently carious; either by an extension of the joint disease, or as the original seat of caries. The *acetabular cavity*, also denuded of cartilage, is enlarged in circumference, but shallow; the cotyloid ligament and bony rim of this cavity having been destroyed. The *round ligament* may have disappeared, and the *capsular ligament* at length giving way, the abscess bursts into the surrounding cellular texture. Thus the joint is utterly destroyed.

*Terminations*.—(1) *Anchylosis* rarely takes place, as a mode of repairation. (2) The remnant of the articular end of the femur is drawn up

by the action of the muscles into the patulous acetabulum. Thence the femur has even been forced through the thinned carious bottom of this cavity, and *entered the pelvis*. (3) But the ill-fitting, loose, articulation from advanced disease, is mostly liable to *dislocation*. The femur drawn upwards and outwards by the glutei muscles, passes over the reduced brim of the acetabular cavity, and slipping on to the *dorsum ilii*, lodges there. More rarely, the femur is thrust out of the acetabulum forwards, and rests on the *ramus* of the *pubes*. *Abscess* finds its way to the surface by burrowing sinuous tracks, and opens in various situations. The openings relate somewhat to the seat of the disease. When it originates in the head of the femur, the sinus extends some way down the thigh, and opens probably near the insertion of the tensor *vaginæ femoris* muscle. Acetabular disease presents a sinus-opening in the gluteal region near the anterior inferior spine of the ilium. Matter may also pass down by the rectum, bursting into it, or close to the anus. If the pelvic bones be involved, a sinus opening is presented in the pubic region, above or below Poupart's ligament; above the ligament, it leads probably to intra-pelvic abscess; below the ligament, to disease of the *rami* of the pubis or ischium.

*Signs*.—(1) Scrofulous disease of the hip-joint approaches, and progresses, very insidiously. Commencing generally in early life, under the age of puberty, scarcely any pain is complained of in the first instance, or for weeks, possibly months, as the disease slowly progresses. The first perceptible sign is a *slight limp* in walking; the child shuffling, hobbling, or dragging his leg, step by step. When standing still, the whole weight of the body is thrown on the other limb, to relieve the halting member. This *attitude* is peculiar; the hip of the sound limb being elevated, gives an obliquity to the pelvis downwards on the diseased side; the thigh is slightly bent on the pelvis, and the leg on the thigh, the toes touching the ground. The limb may be somewhat abducted and everted, the toes being turned outwards; in this particular resembling dislocation on the pubes, or fracture of the neck of the femur. But, in the *first stage* of diseased hip-joint, the limb is *apparently elongated*. This, however, is a *déceptive appearance*, arising from the obliquity of the pelvis downwards towards the diseased hip; measurement with a tape from the anterior superior spine of the ilium to another fixed point below the joint, the inner malleolus, will at once show that there is no elongation in reality. The limb becomes *wasted*, from disease, the gluteal muscles especially; so that the buttock is flattened and flaccid, wider than natural, and the lower fold of the nates less marked. *Pain* is now felt in the hip, or referred more to the inner side of the knee; and the pain in the former situation is aggravated by any attempt to bear on the joint, by abduction, or rotation of the limb, and especially by concussion of the bones, as by striking the trochanter or jerking the limb upwards from the sole of the foot. Pain on the inner aspect of the knee is a sympathetic sensation; depending, probably, on the nervous relation between the hip and knee, through the obturator and perhaps the anterior crural nerves. Both these nerves supply articular branches to the hip, and to the inner side of the knee.

(2) *Real shortening* of the limb—succeeding its apparent lengthening—marks the *second stage*, as it has been termed, of this disease. It coincides with advancement of the disease to *destruction* of the *cartilages* and of the head of the femur, acetabulum, or both bones; whereupon

the limb is drawn up by muscular action. Shortening varies, therefore, in different cases, but it increases as the disease progresses. The *attitude* of the limb is somewhat changed; still remaining flexed, it has now also become *inverted*; in this particular resembling dislocation backwards on the dorsum ilii or into the ischiatic notch. Lateral inclination of the pelvis has, at length, produced a compensatory *lateral curvature of the spine*. Wasting of the limb increases. This shortened, flexed, inverted, and wasted limb; with obliquity of the pelvis and twist of the spine; present a very characteristic appearance. Pain also has become more severe, and aggravated by the attrition of the exposed surfaces of bone, subject to spasmodic muscular action, has acquired the character of *starting pains*.

*Abscess* within the joint bursts into the surrounding cellular texture, and forms a swelling in connexion with the hip; which up to this time had undergone no further alteration than a slight fulness in the groin, and enlargement of the inguinal glands. Abscess-swelling is rendered more conspicuous by the wasting of the thigh and buttock. When, at length, the abscess opens externally, the situation of the *sinus apertures* denotes, as already indicated, the probable seat of the disease; whether in the head of the femur or acetabulum. *Dislocation* is very apt to supervene; commonly on the dorsum ilii; yet, although attended with increased shortening, the attitude of the limb, flexed and inverted, remains the same. But the head of the femur or its remnant, with the great trochanter, can be felt in its new situation, on the back of the ilium; and often very distinctly, the gluteal muscles having wasted so much that the bone seems to lie immediately under the skin. The additional symptoms—wasting of the limb, and sinuses discharging an unhealthy pus and leading down to diseased bone, complete the local diagnostic differences of appearance from *traumatic* dislocation. The general health also has now become worn down by irritation and hectic; and this constitutional condition, coupled with that of the diseased limb, form a picture which leaves little or no doubt as to the nature of the case, not to mention the previous history of its insidious origin.

*Diagnosis*.—Scrofulous disease of the hip-joint is liable to be mistaken for other diseases, if *any one* particular symptom be alone considered. It may resemble rheumatism, disease of the knee, lateral curvature of the spine, infantile paralysis with wasting and defective growth of the limb, psoas abscess, abscess near the joint, inflammation of the bursa under the psoas-iliac muscle, and congenital dislocation of the hip-joint. But the concurrence of symptoms, and as compared with those of each of these diseases, will determine the diagnosis.

*Treatment*.—The directions given with reference to scrofulous disease of the joints generally, are here applicable; rendering any repetition of detail unnecessary. Absolute rest of the joint must be secured, and a position favourable to the future use of the limb, in the event of ankylosis. A splint moulded to the hip and extending below the knee, with the limb straightened, will best answer this twofold purpose. Subsequently, the long straight *extending* splint may be applied with more advantage; thus to counteract muscular spasm and pain coincident with ulceration of the cartilages in contact, and the liability to dislocation as the disease advances. The accompanying extending apparatus is said to answer admirably; but I have had no experience of its use. (Fig. 219.) It is a combination of the leathern hip-splint advocated by Sir B. Brodie,

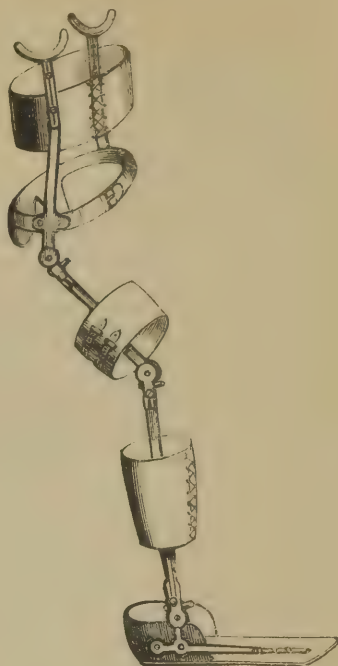


with Dr. Davis's metallic lever; but the simple manner in which it is made to control any rotative or abducting movement of the limb, is peculiar.

FIG. 219.



FIG. 220.



*Contraction of the hip, taking place subsequently, may be counteracted by the annexed apparatus (Fig. 220), which successfully combats each abnormal mal-position of the limb. The pelvic band bears two lateral uprights, upon which the armpits rest, and from which strong laced bands pass around the thorax. This instrument is especially adapted for cases of severe hip-contraction.*

Abscess should be opened to prevent burrowing of the matter among the muscles. The situation of pointing is selected, usually about an inch above and behind the great trochanter. For the convenience of dressing, a long "interrupted" splint may be used. The general treatment, medicinal and hygienic, consists, in a course of iron, quinine, cod-liver oil, and nutritious diet, with as much pure air as possible. I have very beneficially placed my hospital patients in bed in the quadrangle of the hospital, for some hours daily, weather permitting.

This plan of treatment must be pursued for a considerable period—some weeks or months—to solicit ankylosis; or the subsidence of the disease, possibly, after dislocation, and a free discharge of matter with the detritus of the carious bone.

Failing thus to bring the disease to a termination, and the general health declining, operative interference becomes imperative. This will be considered under *Excision of the Hip*.

CHRONIC RHEUMATIC SYNOVITIS OR ARTHRITIS—MORBUS COXÆ SENILIS.  
 —*Structural Condition.*—This disease contrasts with scrofulous disease of the hip-joint, principally in the formation of osseous depositions or outgrowths around the joint, and in the absence of suppuration.

*Signs, and Diagnosis.*—The former structural difference gives to the neck of the bone an enlarged and irregular character; which, however, can scarcely be detected, as a sign, at the bedside. But the *dry* character of this disease,—the absence of suppuration in the joint, and its consequences,—the swelling of abscess and the discharging sinuses which ensue, are perceptibly distinctive. Shortening of the limb to some extent occurs, as the disease advances to destruction of the articular cartilages, with expansion of the head of the bone, and lowering of its neck to even below the level of the great trochanter.

The disease progresses slowly, and is thus clearly distinguished from the sudden result of fracture. Other articulations being or becoming affected, would leave no doubt as to the nature of this condition. The general health is often little disturbed, the disease appearing as a local affection. It seldom occurs under the age of forty; differing in this respect from scrofulous disease of the joint, as well as in its pathology and consequent symptoms.

*Treatment*—see Chronic Rheumatic Synovitis.

NEURALGIA of the Hip.—The *diagnostic* Symptoms of Neuralgia are pointed out in connexion with affections of the NERVES.

Neuralgia of some duration is attended with the alterations of attitude consequent on disease of the joint—whether scrofulous or rheumatic. The weight of the body being habitually thrown on the sound limb to relieve the affected joint of the other side, the limb on *this* side becomes apparently lengthened and flexed, the toes touching the ground; the pelvis is inclined obliquely to the same side, and some compensatory lateral curvature of the lumbar spine results. But, with neuralgia, no real *shortening* of the limb ever ensues.

DISEASE OF THE SACRO-ILIAC JOINT.—*Structural Condition.*—The cartilaginous lamella of the sacro-iliac articulation seems to be the seat of a disease, occasionally affecting this joint. Ulceration of the cartilage, as the primary change, involves the synovial membrane; both of which structures are thus destroyed more or less completely. But, the ligaments remain unaffected, or are only partially destroyed; and the adjoining osseous surfaces do not become carious or necrosed. This disease is of very rare occurrence. It is, however, particularly noticed by Nélaton and Erichsen.

*Signs, and Diagnosis.*—*Pain* is one of the earliest symptoms. It is confined to the region of the joint, and increased by any movement or position whereby the weight of the body is thrown upon the sacro-iliac joint. Thus, walking, stooping, or even standing, is attended with a sense of painful weakness in that situation, and as if the body were falling asunder. When the pelvis is at rest, the *hip* may be moved in any direction without pain. It acquires a gnawing or rheumatic character as the disease advances. Inability to support the weight of the body, occasions an insecure, *wriggling gait*, from side to side; thus differing from the dragging lameness of the limb in disease of the hip-joint. *Swelling* makes its appearance over the joint; it is pulpy and elastic, and of an elongated shape in the line of the articulation. The limb is *apparently elongated*, owing to a drooping of the pelvis on the diseased side, the limb being

disused to support the trunk ; and this side of the pelvis is tilted forwards. Consequently, the anterior superior spine of the ilium, is both on a lower level and more prominent forwards, than on the sound side. Measurement, however, from that prominence to the inner malleolus shows that the limb is not elongated,—that any apparent lengthening—say half an inch, is not due to any change in the three large joints, or in the bones of the limb ; but that it must depend on some alteration above the anterior superior spine. Usually, the limb is *straight*, and becomes *wasted* as the disease progresses.

*Abscess* occurs at a late period. It forms over the diseased articulation, but spreads in various directions. The matter may point posteriorly near the articulation, passing upwards perhaps to the loin, upon and just above the crest of the ilium, there forming a fluctuating swelling of considerable size ; or extending outwards over the buttock, it reaches forwards nearly to the trochanter, as a great gluteal abscess. In both these situations, lumbar and gluteal, the abscess is *extra-pelvic*. *Intra-pelvic* abscess, the matter accumulating within the pelvis, may pass out of the sciatic notch, and thence under the gluteal muscles ; or gravitate downwards into the ischio-rectal fossa, and present by the side of the rectum, or vagina ; or open into the rectum and discharge per anum. *Shortening* of the limb takes place, in consequence of, and proportionate to, the destruction of the sacro-iliac articulation. In one case, related by Sir B. Brodie, the ilium seemed displaced and drawn upwards, so as to shorten the affected limb by two inches.

The *diagnosis* will have to be made—as Mr. Erichsen observes—between this disease, and that of the hip, disease of the pelvic bones, spinal disease, neuralgia of the hip, and sciatica.

*Causes*.—Acute inflammation of this articulation may result directly from *injury* ; as in a case given by Louis, a sack of corn having fallen on the loins of a man who was stooping at the time. In Sir B. Brodie's case, the symptoms seemed referable to pregnancy, four years previously. The disease has a scrofulous origin—according to Mr. Erichsen's experience ; but he has never seen it in young children, only in young adults from fourteen to thirty years old.

I have met with one case only, of this disease, of which the history, by my notes, was briefly as follows. F. H. H., aged eight, a weakly child from birth. The mother states that her four other children all died of water on the brain. Five years ago, this child fell down a long flight of stairs. Four months subsequently, she limped from side to side, in walking, like the motion of a milk-girl in carrying her pails. Shortly afterwards, she had intermittent fever, which lasted about two months. She met with a second fall down a flight of ten steps, and afterwards the limping gait became more marked. Then, the right gluteal region was observed, by her mother, to be larger than on the left side. For two years she continued to walk on crutches. During this period, some slight curvature of the spine had taken place, in the loins, and a spine-support was put on by a surgeon at the Orthopaedic Hospital, in Oxford Street. A swelling presented near the vagina, on the right side, and that in the gluteal region remained. In April, 1866, she was admitted to the Royal Free Hospital. The symptoms were those of the disease in an advanced stage ; abscess occupied the whole of the buttock, and pointed near the vagina ; thus being both extra-pelvic and intra-pelvic. Shortening of the limb, to a slight extent, had occurred, above the anterior superior spine of the ilium.



The *Course* of this disease, as already indicated, is most unfavourable; and thence the prognosis, is equally so. Continuing for months or years, the *termination* is nearly always fatal. In Sir B. Brodie's case, however, although shortening had occurred, recovery ensued.

*Treatment*.—The same treatment, local and constitutional, as for disease of the hip-joint, represents the little that can be done in disease of the sacro-iliac articulation.

Removal of the diseased articular surfaces, by excision, is, of course, out of the question.

## CHAPTER XXXVI.

### DEFORMITIES.

THIS large branch of Surgery forms the subject of several special Treatises. An abstract only—so far as the present discordant opinions respecting much of the pathology and treatment of Deformities, will allow—can be given here; sufficient for the requirements of the general Student, and for reference, in accordance with the design of this work.

Deformities may be arranged in two general classes:—1, Acquired Deformities; 2, Congenital Deformities or Malformations.

Class 1, embraces those deformities pertaining, in origin or result, to:—

- (1) The Integuments—Burn-cicatrices.
- (2) Bones—Fracture-union deformity.  
Rachitis, and Mollities Ossium.
- (3) Joints—Dislocations unreduced.  
Diseases of joints with Anchylosis, and  
Mal-position of the Limb.
- (4) Musculo-Nervous System.  
Spinal Curvature—Lateral.  
Deformities of Face and Neck—Wry-Neck—Squint.  
Deformities of Arm and Hand—Contractions.  
Deformities of Leg and Foot—Relaxations and Contractions—  
Knock-knee—Bow-leg—Club-foot.

The first three of these sub-classes are considered in connexion with other Injuries and Diseases; Deformities as Malformations also are thus associated;—*e.g.*, with Congenital Dislocations, and, with the pathology of Organs and Regions—Hare-lip, extroversion of the Bladder, &c.

It remains only to here notice the affections included in the last sub-class (4); associating therewith any remaining Malformations of musculo-nervous origin or character, as that of congenital club-foot. Even in this sub-class, the following Deformity is more conveniently considered elsewhere.

LATERAL CURVATURE OF THE SPINE.—See SPINE.

DEFORMITIES OF FACE AND NECK.—*Wry-Neck* or *Torticollis*.—This deformity is a twist of the head and neck to one side, in the directions of action of the sterno-mastoid muscle; the head being drawn downwards, sideways, and rotated somewhat outwards. The ear of the affected side may be

drawn down, so as almost to touch the clavicle. Sometimes the face is turned askew, the features losing their symmetry. The sterno-mastoid muscle is firm, and stands out more prominently, though shortened, as compared with that on the opposite side. Other muscles apparently become involved, the anterior margin of the trapezius acquiring an outline which defines the posterior boundary of that named triangular space of the side of the neck. The cervical vertebræ slowly undergo lateral curvature; but probably this symptomatic result occurs mostly in wry-neck connected with disease of those vertebræ.

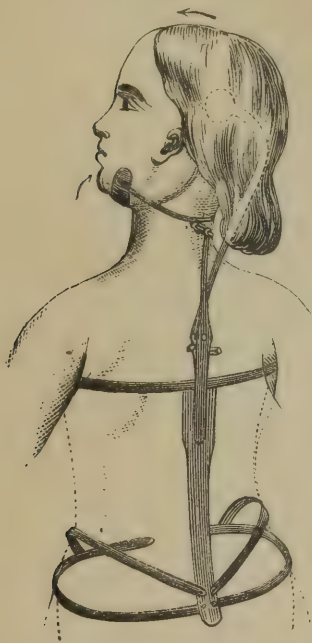
*Causes.*—*Spasmodic contraction* of the sterno-mastoid muscle of the affected side, is the most frequent cause of *spasmodic wry-neck*. The special accessory nerve would seem to be the source of this muscular action, and hence its extension to the trapezius muscle. The spasm is remarkably jerking, painful, and constant, excepting during broken sleep, and it continues for many years; the sufferer ultimately sinking exhausted. This kind of wry-neck usually commences about the age of thirty, and in females, not apparently hysterical, but whose families have an hereditary tendency to other cerebro-spinal affections. *Paralysis* of one sterno-mastoid is a rare cause of *paralytic wry-neck*. The head is drawn to the opposite side by the healthy muscle, not being counteracted by its antagonist. *Disease of the cervical vertebræ*, of scrofulous or rheumatic character, occasionally gives rise to the deformity. The *exciting* cause would appear to be, not unfrequently, exposure to cold, or some occasion of local irritation or inflammation of the cervical glands, resulting in stiffness of the neck. Burns of the neck, followed by contraction of the cicatrix, occasion remarkable distortions resembling wry-neck; but not depending on any affection of the muscles, they are thus distinguished from wry-neck thence arising. *Congenital wry-neck* is said to be the most common form of this affection. The side of the head, neck, and shoulder which present the deformity, are considerably smaller than the parts on the opposite side; the shoulder and scapula are unduly raised, and the features drawn down and unsymmetrical. The sterno-mastoid muscle is reduced to a narrow, shortened cord, hard and tense. Curvature of the cervical spine has taken place, laterally to the opposite side, and a compensating curve in the opposite direction lower down.

*Treatment.*—Tenotomy or the subcutaneous division of tendons, and muscles, represents a principle of treatment, applicable to a large class of conditions; for the cure or correction of deformities depending on muscular contractions. Stromeyer introduced this principle, in 1831; and he was followed by other surgeons, who have established its remedial efficacy in various branches of Surgical Practice.

*Division of the sterno-mastoid muscle, subcutaneously.*—This procedure affords more or less complete relief of tension, when wry-neck deformity depends on contraction of the sterno-mastoid muscle. Thus, in spasmodic wry-neck, tenotomy is most successful, and in congenital wry-neck, less so; while in the paralytic form, and that arising from disease of the cervical vertebræ, this operation will be unnecessary or useless. The muscle should be divided close above the clavicle, the situation of least risk to subjacent parts. By introducing a narrow-bladed tenotome just above the sternum, the sternal attachment of the muscle is divided; and then the clavicular attachment, by repuncturing the integument in that situation. This precaution is safer than division of the muscle by one incision; as the two portions are not on the same plane, and passage of

the knife to a sufficient depth for that purpose would be dangerous. Complete division is accompanied by a very sensible crack, and some alteration in the attitude of the head. Immediately after operation, Dr. Little found the difference in length between the affected and sound muscle reduced more than one-half.

FIG. 221.



The advantage gained by the operation, must be followed up by mechanical means to maintain and gradually complete the readjustment of the head in position; otherwise, the divided portions of muscle reunite, and the deformity returns. An apparatus invented by Mr. Bigg (Fig. 221) best answers this purpose; by counteracting any tendency of the head downwards, sideways, and outwards, and thereby restoring it to its vertical position and the chin to the middle line. Dr. Little highly commends cautious manipulation daily, as well as the use of a retentive apparatus. This after-treatment must be continued for a period varying from one to three months, when permanent cures have been accomplished.

Paralytic wry-neck may be rectified by strychnine, electricity, and other measures for the restoration of nervo-muscular action. A steel-spring cravat or other contrivance for supporting the head, is the only mechanical resource available.

Disease of the cervical vertebræ, as the cause of wry-neck, can be remedied only by the measures—medicinal, dietetic, and hygienic—appropriate for the particular constitutional condition; and by wearing a well-adjusted, supporting, and slowly rectifying apparatus.

**STRABISMUS OR SQUINT.**—A want of parallelism in the axes of the eyes, whenever both are directed to an object at the same time. This habitual mal-position of the eyes results from irregular action of the internal or external rectus muscle; the one producing *convergent* strabismus—the eye being directed towards the nose; the *divergent* strabismus—the eye being directed towards the temple. Either form of strabismus may be *single*; *double*, when both eyes converge or diverge. The latter direction is rare, and consequent on loss of sight in one eye, which has lasted for years.

**Causes.**—Strabismus may arise from a cause remote in some distant part of the body, of which the squint is symptomatic; or from various local conditions pertaining to the eye; but more frequently from the former class of causes. Thus, this affection may arise from intestinal irritation or teething; or from disease of, or relating to, the brain, as hydrocephalus. It may be consequent on certain blood conditions, as measles or scarlatina, among the eruptive fevers. Inflammatory, or other diseases, of the eyeball, conjunctiva or eyelids. Extreme shortness of



sight, compelling the patient to converge both eyes in looking at near objects, may induce strabismus; and it sometimes results from the influence of insensible imitation.

*Treatment.*—Removal of the cause, in any case, will probably restore the regular and equal action of the recti muscles. Hence, any source of irritation in the intestinal canal or elsewhere, should be sought for, and removed, if practicable. Persistent causes render this principle of treatment impracticable, and strabismus must then be rectified as an effect, by division of the contracting muscle. This operation, first introduced in 1810, has since been modified. It now consists in *sub-conjunctival* division of the muscle affected; commonly the internal rectus. The details of this procedure are described in the chapter on Diseases of the Eye.

DEFORMITIES OF ARM AND HAND.—Contraction of the muscles of the upper extremity differs from those of the lower extremity, in so far as the individual muscles of their analogous parts perform functional movements, more delicate, varied, and complex. Various muscles may be affected, producing deformities which correspond to their respective functions. Thus, contraction of the biceps, with permanent flexion of the arm, or the extensors of the forearm, the flexors of the fingers, or those of the wrist, or the pronators; may be severally engaged. As affecting the fingers, muscular contractions produce forms of *club-hand*.

The *causes* of these contractions, and resulting deformities, are either spasmodic or paralytic conditions; and as depending on some injury or disease affecting the nervous system peripherally or centrally.

*Treatment* must have reference, primarily, to removal of the cause of contraction or paralysis, if possible. But the state of contraction, as an effect, may be overcome mechanically; by manipulations, or by division of the contracted muscle or muscles, or their tendons—the operation of tenotomy; followed, in either case, by the use of retentive appliances.

The choice of these two procedures will be determined by the kind and degree of motion to be regained in the part, and by the practicability of aiding recovery by means of any apparatus.

Thus, according to Dr. Little's experience, the biceps at the bend of the elbow, the tendons of the flexor carpi radialis and ulnaris close to the wrist, and the pronator radii teres at its muscular portion, have been severally divided in different cases; but the resulting benefit of these procedures has been proportionate to the after-manipulations, passive exercises, and painstaking education of the enfeebled non-contracted extensors. The fingers derive little benefit from any limited degree of the simple movements of flexion and extension, nor can they be assisted by any known form of mechanism.

*Contraction of the Fingers from disease of the palmar fascia*, should be distinguished from contraction of nervo-muscular origin. The pathology of this condition was discovered, on dissection, by Dupuytren and Goyrand.

It results not unfrequently from habitual pressure on the palm of the hand, as in bearing on a knob-headed walking-stick, or using an instrument which has this effect, in the exercise of various trades. Or, without any apparent exciting cause, a rheumatic or gouty diathesis may give rise to chronic thickening of the palmar fascia, in the form of projecting ridges extending from the palm to the contracted fingers. (Fig. 222.)

The *treatment* is, in principle, the same; division, subcutaneously, of any tense *fascial* prolongations binding down the fingers. Sometimes,

firm adhesion of the skin to these bands necessitates its separation, by a long incision and dissection of the skin back on either side; the bands must then be divided or dissected off the tendons, leaving their sheaths intact. After either operation, the fingers are to be straightened and retained in position on a splint.

FIG. 222.



*Congenital Deformities of the Fingers* may be met with. Erichsen saw a case in which the fingers appeared as if they had undergone complete or partial amputation *in utero*. Some were marked by deep transverse sulci, others shortened and terminating in rounded nodules, with a narrow pedicle attaching them to the proximal phalanx. *Supplementary* fingers, or a thumb, are also met with. (Fig. 223.)

FIG. 223.



DEFORMITIES OF LEG.  
—(1) *Knock-knee* or *In-knee* — *Genu Valgum*. —

This deformity is an inward yielding of the knee-joint, the result of weakness of the ligaments and muscles which support the joint in that direction. It occurs not unfrequently, and usually both knees are affected; giving the person a singularly ungraceful attitude when standing, and in walking the knees knock and roll over each other with a shuffling gait.

The *causes* of knock-knee are apparently *mechanical*; some occasion of undue strain on the knee. It mostly arises from trying to make a child walk too early, or it may occur in tall, rapidly-growing lads from the age of twelve to eighteen; in either case the knees yielding under the weight of the body. Habitual over-walking exercise or fatigue in standing, has the same result. Hence certain occupations are causative; and any habit of resting on one leg, or defect in the opposite limb, whereby an increased strain is thrown upon the sound limb; may induce this deformity. But, a rachitic tendency, or other *constitutional* condition of impaired nutrition, can often be traced as the predisposing cause.

*Treatment*.—Removal of the cause in operation, will sometimes prove sufficient. Thus, if the attempt to make a child walk at too early a period be discontinued, an incipient knock-knee may disappear.

*Mechanical support* is the only sure means of preventing further deformity, and of restoring the limb to a proper shape, by allowing the ligamentous structures to gain sufficient strength. The patient must be placed in “irons.” An iron stem, on the outside of the limb, extending from the trochanter to the outer ankle, is fixed by a pelvic band above, and into the boot below. A hinge in this rod at the knee allows of motion; while, by means of a leathern pad furnished with straps, applied on the inner side, the joint is secured to the stem above and below the hinge, and drawn outwards by tightening the straps. (Fig. 224.) The knee must thus be fixed during a period varying from three to six

months; then freedom of motion may be allowed for a part of each day during a similar period; and lastly, perfect freedom a few months before the support is discontinued. The total average duration of treatment, in advanced childhood and bad cases, will probably extend to two years.

*Division of the external lateral ligaments*, or of the *biceps tendon*, has been practised in obstinate cases; but this, or any cutting operation, is not now considered necessary. Constitutional treatment for the improvement of nutrition, will aid the mechanical cure.

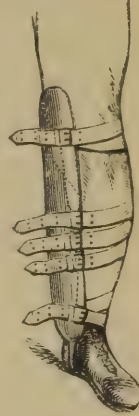
FIG. 224.



FIG. 225.



FIG. 226.



(2) *Bowed, or Banded Legs*, present the opposite state of deformity of the Knees. (Fig. 225.) The *treatment* will consist in a form of apparatus to correct eversion of the Knee. The simplest is an inner lateral splint (Fig. 226), as a base opposed to the convexity of the curve.

(3) *Contraction of Knee-joint*.—Unconnected with disease of the joint, resulting in ankylosis with malposition; *simple* contraction of the knee is liable to occur. The deformity may be either, *flexion* of the leg on the thigh, at an angle of various degrees; or, combined with this state, some distortion *laterally* inwards, with rotation of the tibia outwards. Displacement *backwards* of the head of the tibia, the end of the femur and patella projecting forwards apparently, is associated with rather an extended position of the leg, and laxity of the joint.

FIG. 227.



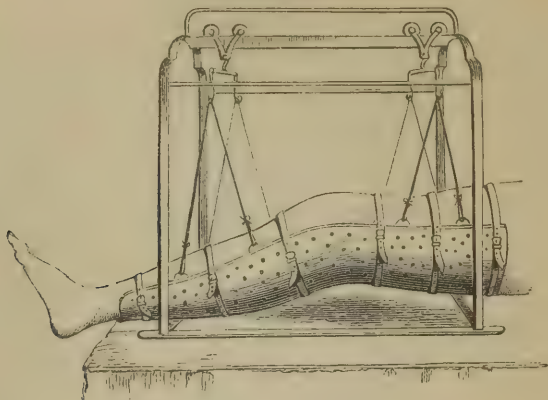
The *cause* of these deformities—apart from joint disease—seems to be



some affection of the ham-string muscles, which induces their contraction, and shortening ultimately. This may be a purely *hysterical* manifestation, and accompanied with other symptoms of the same constitutional disease.

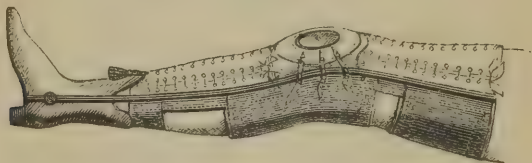
*Treatment* must have reference to the apparent cause of contraction. The more fugitive state of hysterical contraction, may perhaps be overcome under the relaxing influence of chloroform; the limb is then at once

FIG. 228.



brought down to a straight position, and retained by two lateral splints. (Fig. 227.) Or, reduction is gradually accomplished by a regulated extending apparatus. (Figs. 228, 229.) Division of the ham-string tendons

FIG. 229.



may be necessary, followed by extension. The biceps and semi-tendinosus always require division; the semi-membranosus, seldom. This renders the operation more superficial and simple than it would otherwise be.

**TALIPES OR CLUB-FOOT.**—Four forms of club-foot are recognised; *talipes equinus* or elevation of the heel; *talipes varus* or inversion of the foot; *talipes valgus* or eversion of the foot; and *talipes calcaneus* or depression of the heel with elevation of the anterior part of the foot. *Varieties* of club-foot consist of combinations of two of these forms, the principal of which are; equino-varus, equino-valgus, varo-equinus, calcaneo-varus, and calcaneo-valgus.

(1) *Talipes-equinus.*—*Structural Condition, and Signs.*—Certain bones of the tarsus—the astragalus, scaphoid bone, and calcaneum, have undergone alterations from their normal condition. Diminished in size somewhat; the astragalus, in particular, is reduced, its natural articular surfaces for the tibia and fibula are partially deprived of cartilage, and new articular relations have formed posteriorly, more or less in that

direction according to the degree of the talipes. The calcaneum may even contribute to this new articulation. The head of the astragalus, diminished in size, has an unusually small articular facet in its connexion with the scaphoid bone. This bone also reduced in size but unaltered in shape, is drawn downwards; thus presenting the head of the astragalus prominently on the dorsum of the foot, while a considerable portion of its upper surface has slid from under the tibia. The calcaneum small, and perhaps articulating with the tibia, has a more limited connexion with the cuboid bone; and as this bone, with the scaphoid, is drawn downwards, the anterior and upper portion of the calcaneum also projects forwards on the dorsum of the foot. The other bones of the foot, somewhat smaller than natural, retain their normal characters; the remaining tarsal and the metatarsal bones conform to the general curvature—an increased convexity forwards, an increased concavity backwards; but the toes are, usually, extended, horizontally.

Thus, then, the heel drawn up, in this form of talipes, brings the tarsus to nearly a vertical line under the tibia, whereby the weight is transmitted to the toes, on which the patient rests in standing or walking. (Fig. 230.) The ligaments are relaxed and shortened, corresponding to the altered relations of the bones; which facilitates the progress of the deformity, and impedes restoration of the foot to its natural position. The muscles, however, are the active agents in the production of talipes, one muscle or set of muscles overbalancing another and antagonistic muscle or muscles. In talipes equinus, the *gastrocnemius* muscle is contracted.

This form of talipes is usually single; but both feet are sometimes clubbed.

*Causes.*—The disturbed equilibrium of muscular action, in the production of club-foot, may be spasmodic, when referable to the contracted muscle; or be due to paralysis of the opponent muscle. Thus, in talipes equinus, spasmodic contraction of the *gastrocnemius*, may give rise to this deformity; or a paralytic state of the *tibialis anticus*, or of it and one or more of the other extensors of the foot, be the cause in question. *Exciting* causes comprise various sources of irritation, operating through the nervous system, as teething, intestinal worms; or some local irritation, as an inflammatory affection of the muscles of the calf of the leg.

Talipes equinus may be acquired or congenital; the latter very rarely, Tamplin, Lonsdale, and other authorities never having seen such a case.

*Treatment.*—Tenotomy is the only mode of cure. Division, subcutaneously, of the tendo-Achillis, allows the heel to be brought down; when the foot must be retained in position by a properly constructed extending apparatus.

FIG. 230.



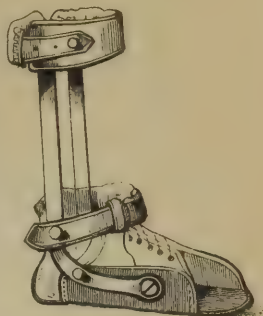
The operation is simple. The patient having been laid prone, the Surgeon grasps the foot and extends it forcibly, thus making the tendon

Fig. 231.



tense and prominent; a tenotomy knife (Fig. 231) is introduced, at either side of the tendon, about an inch above its insertion into the calcaneum; passing beneath the tendon to its opposite side, the knife is withdrawn through the tendon slowly, its fibres yielding with a creaking resistance. The foot at once comes into position, or is readily brought down by extension with the hand, as the tendon is divided. Scarcely more than a drop or two of blood escapes externally, and the puncture is closed by a small piece of plaster.

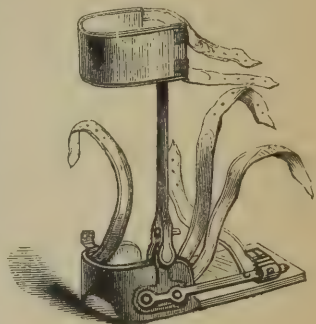
Fig. 232.



The apparatus for extension is Scarpa's shoe, or its modification by Liston. Liston's shoe was provided with two curved levers. (Fig. 232.) The form of apparatus, or shoe, generally used for talipes equinus, is here represented. (Fig. 233.) It consists of a steel splint on the outer side of the

Fig. 233.

leg, with a foot support; both of which are secured by padded belts around the leg and foot. At the connexion of the splint and foot-board, a joint, worked by a key, regulates the extension.



Stromeyer postponed extension until the puncture-wound had healed; and then applied it gradually. The former rule is now obsolete in practice; the latter is observed by Little and most authorities. In my own more limited experience I have always employed gradual extension, after tenotomy. Union of the tendon becomes more perfect, and without entailing any risk of recurring deformity. Walking may be resumed as soon as union has taken place and the movements of the foot are regained, without any tendency to relapse; the period of rest required being, of course, much lessened by wearing the precautionary apparatus above described.

(2) *Talipes Varus*.—The pathology and treatment of this deformity much resembles that of talipes equinus.

The *structural condition* is similar, with regard to the alterations of the bones. But the muscles contracted are principally, the gastrocnemius, with also the tibialis anticus and posticus. The articular alterations, and the accompanying signs, are more like those of equinus, in proportion to the extension and curvature of the foot, which commonly occurs; but the foot is turned *inwards*, and this is the characteristic distinction. The patient walks on the outer side of the foot. (Fig. 234.)

The *causes* of this deformity would appear to be those of talipes equinus; but the varus form of talipes has been attributed to pressure of the walls of the uterus. It is certainly most frequently congenital;



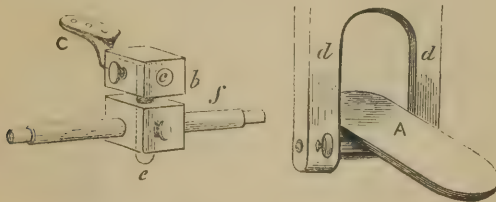
almost as exclusively so as the equinus form is acquired talipes. Both feet, therefore, are usually affected.

FIG. 234.



*Treatment* consists, in subcutaneous division of the tendons of the contracted muscles; the tibial muscles, and the tendo-Achillis; followed by the use of Scarpa's shoe or Aveling's talivert (Fig. 235), to complete

FIG. 235.

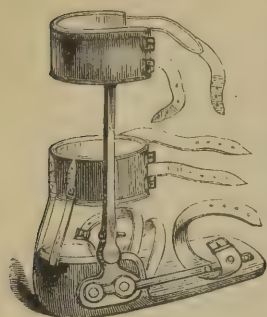


the cure. By the latter apparatus, the three desiderata,—abduction, flexion, and retroversion, are obtained. A, metal shoe-piece; *d d*, lateral uprights of leg-splint; adjoining fig. *b*, etc., represents the extending apparatus.

In performing the operation of tenotomy, the posterior tibial artery, near the posterior tibial tendon behind the malleolus, is the only vessel liable to be injured; and with it, the companion nerve. This accident has happened in the most experienced hands; a compress and bandage will, mostly, arrest any hæmorrhage thence arising. In only one instance, has Dr. Little witnessed any evil consequence; a small filbert-sized aneurism requiring ligature of the vessel, three weeks after operation. A relapse, or rather conversion of the deformity into the opposite state, sometimes occurs; talipes valgus succeeding. In one case under my care, it was necessary to have recourse to the operation for that deformity. The shoe, most frequently used at the Royal Orthopædic

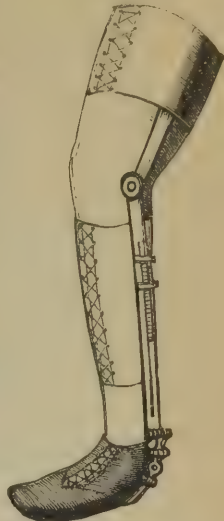
Hospital, is here shown. (Fig. 236.) Dr. Langaard's well-known instrument for talipes varus, is also deserving of notice. (Fig. 237.)

FIG. 236.



(3) *Talipes Valgus*—or *in-ankle*—presents the opposite arrangement of parts to that of talipes varus, and the peronei muscles are chiefly contracted. The foot is turned *outwards*, and possibly extended upwards, the patient standing or walking on the inner ankle. Thence also the knee inclines inwards, combining knock-knee with this form of

FIG. 237.



talipes.

*Flat* or *Splay-foot* presents the same characters as the above deformity; but, owing to relaxation of the ligaments in the sole of the foot, the arch sinks, and the foot is flattened.

The *causes* of talipes valgus have reference to the contracted muscles, and this deformity may be congenital or acquired.

Flat-foot is said to arise, in young persons, from long-continued standing or walking. I have seen it commence in girls who have suddenly become stout and heavy, about the age of puberty; the arch of the foot and inner ankle then giving way.

FIG. 238.

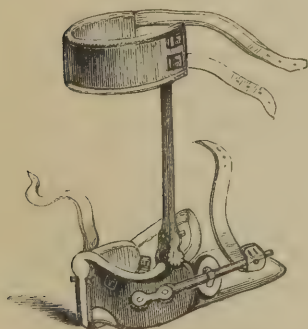


FIG. 239.



The *treatment* of talipes valgus must be conducted on the principles already laid down in the other forms of club-foot. Tenotomy will generally be necessary; and the tendons to be divided are those of the peronei muscles, and possibly also, of the extensor communis digitorum. The foot is then placed in a Scarpa's shoe. The best form of instrument is that devised by Dr. Langaard, of Hamburgh. (Fig. 238.) It is provided with a tangential ankle-screw.

Slight deformity of this kind can sometimes be corrected by extension, under the influence of chloroform; and subsequently wearing the shoe.

Flat-foot is amenable to the same plan of treatment, with the addition of a convex sole to restore and support the arch of the foot.

(4) *Talipes-calcaneus*.—Marked depression of the heel, and a corresponding extension upwards of the foot, characterize this deformity. The plantar arch may be contracted. (Fig. 239.) No structural alterations have taken place, but the deformity is simply symptomatic of muscular contraction; the muscles engaged being the four whose tendons pass between the two malleoli, anteriorly;—the tibialis anticus, extensor pollicis, extensor longus digitorum, and peroneus tertius, a part of the last-named muscle. The lateral ligaments, in their posterior portions, are much elongated.

This form of talipes is very rare, and was first described by Dr. Little, in the case of a child, four and a half years of age.

The treatment is much facilitated by the absence of any structural

FIG. 240.

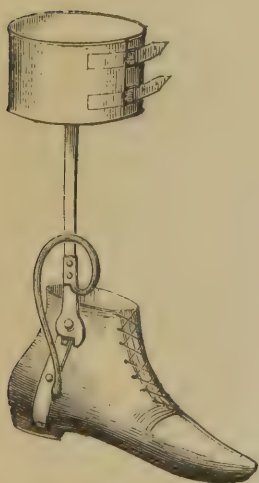
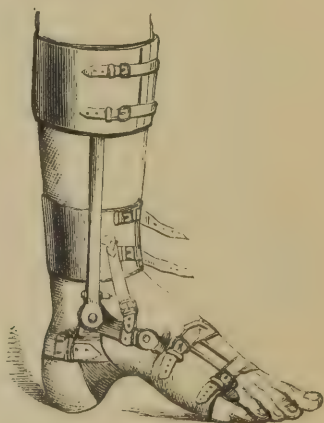
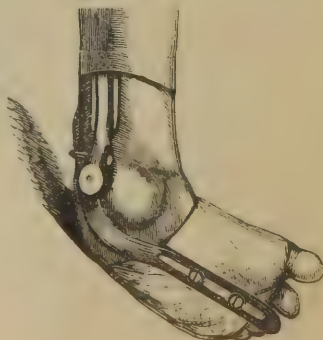


FIG. 241.



impediments. Reduction can be easily accomplished by flexion alone, or aided by tenotomy; and the foot is readily retained in position. The best form of instrument, or shoe, for treatment mechanically, in order to restore the normal position and actions of the foot, is that shown in the annexed figure. (Fig. 240.) Bigg's apparatus is well adapted for cases of great severity. (Fig. 241.)

FIG. 242.



*Varieties of Club-foot*.—Combinations of the typical forms of club-foot are liable to occur. They have already been adverted to; but, to simplify the descriptions given, it was desirable not to introduce these varieties in connexion with their respective types.



*Equino-varus*, *equino-valgus*, *varo-equinus*, *calcaneo-varus*, and *calcaneo-valgus*, are modifications of the typical forms of club-foot. The particular muscles contracted will be suggested by each of these varieties of deformity. But the muscles engaged are declared by the tension and prominent rigidity of their tendons, as at once discovered by manipulative examination of the foot, in the various attitudes it has assumed.

Practically, this knowledge guides the appropriate orthopædic treatment; the manipulative extensions, the operations of tenotomy, and the mechanical appliances. For *equino-varus*,—to restore the foot to a normal position, Bigg's Orthopæde promises to be a valuable instrument. (Fig. 242.)

## CHAPTER XXXVII.

### EXCISIONAL SURGERY OF THE JOINTS, AND BONES.

#### THE JOINTS, FOR DISEASE.

EXCISIONAL SURGERY is best introduced by defining its full signification. Excision—or Resection, as it is sometimes less properly called—signifies the removal of any part of the body by a cutting-out operation of extirpation. This kind of operation relates chiefly to the joints and bones, although it may be practised also for the removal of tumours, as adventitious growths produced in connexion with the natural organism. The object of excision is, therefore, to preserve or to restore the organism, as far as possible, in or to its healthy anatomical integrity. With regard to the osseous system, comprising the joints and bones, excision may be practised either for disease or for injury of these parts.

In approaching this subject we may just take a retrospective glance at its history and time-honoured associations. Hippocrates, in whose writings 2400 years ago so many other surgical aspects of the present age are reflected, distinctly notices the resection of bones at the joints,—as of the leg, the ankle, the forearm, the wrist. Then, again, we find Celsus and Paulus Ægineta both as explicitly directing the excision of the ends of bone,—the one in compound dislocations, the other in compound fractures with protrusion. But the latter writer refers also to the practice of excision for disease of the joints or of the bones: “When,” says he, “the extremity of a bone near a joint is diseased it is to be sawn off: and often, if the whole of a bone, such as the ulna, radius, tibia, or the like, be diseased, it is to be taken out entire.” Thus, then, excisional surgery had its origin in that fertile period of the world's history when arts and literature flourished. Subsequently, in the course of those dark and dreary middle ages, when the human mind lay dormant, as in a death, it is scarcely possible to trace a vestige of that which was destined to become a leading feature of modern surgery. Not until towards the close of the last century were the operations of joint-excision fully recognised. In 1781, Park, of the Liverpool Hospital, excised the knee-joint, and with a successful result. This was followed by a second successful operation on the knee, in 1789. Contemporaneously, in France, the Moreaus, senior and junior, practised excision of this joint, between the years 1786 and 1789: and then of the elbow-joint, the one surgeon in 1794, the other in 1797.

The efforts of Park and Moreau failed to make any, the slightest, impression on the profession or the public. In September, 1782, Park wrote to Percival Pott, of St. Bartholomew's Hospital, "a few sheets, in which," said he, "I hope to show that in some of the affections of the knee and elbow in which amputation has hitherto been deemed indispensably necessary, surgery has yet another resource, which, as far as my reading and experience enable me to judge, has not yet been attempted by any other practitioner—I mean, *the total extirpation of the articulation*." He emphasized his suggestion by underscoring it, as an indication for italics. This announcement, however, seemed in no way to have moved the original mind of the famous metropolitan surgeon. On the Continent, the memoirs offered by the Moreaus to the French Academy provoked violent opposition, and were rejected with disdain by the surgical *savans* of France. Thus it was that towards the close of their labours the pioneers of excisional surgery experienced the mortification of knowing that they had attracted no followers—no successors.

It is unnecessary to pursue this general historical sketch further; those who revived the operations of excision, and subsequent contributors, will be amply noticed in connexion with the consideration of the several joints.

*Joint Excision in relation to the General Treatment of Joint Disease.*—In the pathological history or course of inflammatory joint-affections, certain general indications of Treatment may be recognised, which, in the order of their conservative or preservative character, admit of the following arrangement; and whereby the *relative* bearing of Excision, will become apparent.

The *Non-operative* indications comprise:—

(1) Preservation of the Joint, functionally, by restoration of its mobility.

(2) Preservation of the Joint, with loss of its mobility, by Anchylosis.

The *Operative* indications are:—

(3) Preservation of the Limb, and Life, by sacrifice of the Joint, with anchylosis—*Excision*.

(4) Preservation of the Life alone, by sacrifice of the Limb—*Amputation*.

The question of operative interference, it will thus be seen, can arise only when the joint-disease is already past the control of the first indication of treatment—restoration of the mobility and functional use of the joint; and when it has become subject to the second indication—preservation by anchylosis. But this result is also the object of Excision. The true comparison, therefore, of joint-excision for disease, is with the probability of *natural* cure by anchylosis. Such comparison should have reference, (1) to the joint, in respect to five essential particulars—the appropriate nature of the anchylosis or union, and the proper position of the limb for its functional use, the average duration of the periods of recovery, and the permanent character of that issue, with its average proportionate frequency; (2) the liability to life, or the comparative mortality of the natural cure by anchylosis and that resulting from excision, must also be considered. It may seem strange to speak of the mortality of the *natural cure*, for it might be said, that failing to obtain that issue in due time, the surgeon would interfere by an operation, either of excision or amputation, before death ensues. But the period of natural cure is very protracted, extending often to five years or more, and even to ten years. Cases of this duration respectively—not, it must be confessed, of a very

inviting and encouraging character, are recorded by Mr. T. Bryant and Mr. Hilton, as having occurred in their practice for the mechanical cure of knee-joint disease. But even a more important consideration, is this—that such protracted recovery is attended with a proportionate reduction of constitutional vigour. Hence, with reference to the question of mortality, operative interference may be too late, or intercurrent disease consequent on delay, may carry off the patient; in either case, death ensues from the prolonged attempt to bring about a natural ankylosis.

Statistical results, bearing on all these questions, and which shall be sufficiently accurate and comprehensive, are yet wanting to determine the relative value of the two modes of cure—nature *versus* excision. Meanwhile, the fair and reasonable course to take surgically, in any advancing case of inflammatory joint-disease, is; to try for natural ankylosis by absolute rest and other proper treatment; and failing to obtain that issue, timely excision offers as a subsequent resource, under the conditions which are most favourable for a successful result to this operative procedure. What are they?

By an analysis of twenty carefully recorded typical cases, published in the Medico-Chirurgical Transactions of last year (1870), I endeavoured to establish three propositions, representing the conditions of disease appropriate for excision of the joints in general; and certain supplementary propositions relating to particular joints. The experience of eight additional cases enables me to confirm and enlarge these conclusions, and, so far as they may stand the test of further experience, they may be taken as principles or rules for the guidance of the surgeon in his selection of this operation. I may here state that this series of cases is *consecutive*—*i.e.*, it comprises *all* the cases in which I have had recourse to the operation of joint-excision. No adequate basis for generalization can be afforded by any limited series of cases; but my own have the advantage of preconsidered observation and analysis specially with a view to the purpose proposed; and I have supported my conclusions by large masses of evidence carefully gathered from recorded sources of trustworthy results.

#### GENERAL CONDITIONS OF DISEASED JOINTS APPROPRIATE FOR EXCISION.

—*Functional imutility* of a Joint, is the *resultant* condition for which the operation of Excision is appropriate; but as this may ensue either from persistent disease, or from failure of the natural cure, of a twofold character, it includes three general conditions, proper for the operation:—

*Firstly*,—as the result of persistent disease—destruction of the articular cartilages, with perhaps dislocation, without the supervention of ankylosis; but, whilst the *constitutional* condition has not advanced to hectic and emaciation.

*Secondly*,—as one result of the natural cure—Ankylosis, of a nature inappropriate to the functional use of the limb; being ligamentous where osseous union is required, as in the knee; or osseous where ligamentous-connexion is necessary, as in the elbow.

*Thirdly*,—as another result of the natural cure—Ankylosis, with mal-position of the limb. In the event of *fibrous* ankylosis, with mal-position; mechanical extension of the limb, tenotomy, or both these resources may be tried prior to excision of the joint.

Certain *subordinate* conditions, relative to the propriety of Joint-Excision for persistent disease, are less clearly established by an analysis of cases.



(1) The comparative eligibility of chronic synovitis or of scrofulous caries, would appear to be in favour of the former disease. Thus, in my knee-joint excisions; of the 12 cases, the 3 which required secondary amputation were cases of scrofulous caries; of the remaining 9 cases, 6 were synovitis, and 3 scrofulous caries.

Professor Humphry's experience is somewhat different—at least with regard to the knee-joint—prolonged scrofulous suppuration of the thickened synovial membrane having been the most frequent cause of failure after excision, in his cases. (*Medico-Chirurgical Trans.*, 1869.)

(2) A limited extent of osseous disease, would seem to be proportionately favourable for excision; but, one or both articular surfaces, or *ends* of bone, may be diseased. The disease must not extend beyond the limits necessary for the formation of sufficiently wide osseous surfaces for an adequately secure union, osseous or ligamentous according to the functional use of the limb. Or, the limits of diseased bone, with relation to excision, may have to be restricted for the preservation of a sufficient length of limb; and, consequently, for the preservation of the epiphyses or epiphysal cartilages, as affecting the subsequent growth of long bones, and thence of the limb. The epiphyses of the tibia and femur, in the knee-joint, for example, in relation to the growth in length of the lower limb, after excision of this joint.

(3) Disease of the soft parts around the joint diseased, is not, in itself, unfavourable to the result of excision; even although the integuments be much undermined by sinuses, and thickened by gelatinous infiltration, or soddened by puriform discharge. This surrounding condition of disease will subside, and the integuments regain a healthy state, when the central source of irritation, the diseased joint, is extirpated; provided only sufficient sound integument be left to cover the exposed ends of bone. But, advanced integumentary disease is generally connected with advanced constitutional disturbance and hectic exhaustion, the most unfavourable condition for joint-excision.

(4) A chronic state of disease, in the joint and surrounding soft parts, is a condition of far more favourable character for excision, than one of acute inflammation.

(5) In all doubtful cases, as to the diseased condition of the joint; a good practical rule is, to lay the articulation open, by an incision as for the operation, and examine its condition, before having recourse to amputation, which can then be performed at once.

(6) Certain co-existing constitutional diseases, as phthisis, seem to have an unfavourable influence, and in proportion to the progress of such disease.

(7) Age has no special constitutional relation to the propriety of joint-excision. Either extreme period of life seems unfavourable for this kind of operation, owing to the long period of recovery, averaging three months at least, for the knee or hip-joint; and six weeks for the elbow-joint. As to extremes of age; taking the knee-joint as the best example of a large joint; according to Dr. R. Hodges, excision has been performed as early as three years, and as late as sixty-eight years. The former case recovered, with what state of after-limb is not recorded; the latter died. The average age of the fatal cases was twenty-five years; of recoveries, nineteen years. Of my own cases, the first, and one of the most successful, was thirty-three years old, and another, equally successful, was twenty-seven. But, the constitutional power of recovery from

severe compound fracture, after either of these periods of life, would suggest the propriety of trying excisions at a more advanced age. *Youth* may be unfavourable for the operation, as being subject to an arrested growth of the limb, from removal of the epiphyses or epiphysal cartilages. But this objection relates only to knee-joint excision, the length of the arm, after operation at the elbow-joint, being comparatively unimportant; and even with regard to the lower limb, the line of epiphysal cartilage may not unfrequently be left, thus providing to some extent for the subsequent growth of the limb in length.

**OPERATION OF EXCISION.**—Certain general directions are common to all these operations.

*Instruments.*—The requisite Instruments, and Apparatus for after-treatment, are few and of simple construction. They comprise;—scalpels, thin and stout-bladed, curved copper spatulæ, saws—the common amputating saw and Butcher's saw, the chain-saw; gouges, and cutting plier-forceps, the lion-forceps for grasping bone, torsion-forceps, suture-needles, and silk or silver wire; splints and bandages, or other retentive apparatus.

This list of armamentaria might be extended, and many and complicated instruments are described, particularly by French authors. It would, however, appear doubtful whether some such appliances can possibly be used, in accordance with the design of Excision. Some, indeed, of the above-mentioned instruments are of restricted applicability, and come into use only occasionally. Thus, for joint-excision, the saw devised by Mr. Butcher, has a narrow blade, and being moveable, it can be adjusted at any angle; an advantage for running the saw easily, and in any direction, to finish off the excision. But, for the removal of an accessible slice of bone, the firm bearing of the ordinary broad-bladed amputating saw, is preferable. The chain-saw also will be requisite only under quite exceptional circumstances; as to get round an imbedded bone, and which cannot be exposed and turned out as usual, for application of the ordinary broad-bladed saw. This is a rare expedient, and I have never had occasion to resort to it, except in excision of the great trochanter; I have seen the chain-saw used in excision of the hip, but not with any apparent advantage; and once the instrument broke. The "lion-forceps," devised by Sir William Fergusson, enables the operator to gain a firm grip of the off-portion of bone, in order to steady it for the efficient and free working of the saw. This instrument thus proves serviceable in completing the excision of any partially severed portion of bone.

Ligatures are scarcely ever necessary for the arrest of hæmorrhage; torsion will generally prove sufficient. I have never found it necessary to apply a single ligature in any joint-excision; nor subsequently, but once, on account of secondary hæmorrhage. Silver wire is, perhaps, preferable to silk for sutures; the latter material being apparently more apt to induce suppuration, at the points of insertion along the line of incision.

(1) The *incisions* should be formed so as to fairly expose the articular ends of bone. Hence, they vary in shape according to the particular joint; a single linear incision, **I**, as frequently practised for exposure of the elbow-joint; a double rectangular incision, **—**, as also applicable to the same joint; or, as a **T** shaped incision, to the hip-joint; a curvilinear or elliptical incision, **U**, for the shoulder, perhaps the wrist, and the knee: or, an **H** shaped incision, as some Surgeons prefer for the latter joint;

and modifications of these incisions for the ankle-joint. The incisions are so placed as to avoid important parts—tendons, blood-vessels, and nerves; and, therefore, not in the flexure of joints.

(2) The ends of bone should not be denuded of their *integument* or of their *periosteum*, to any extent beyond the line necessary for the osseous excision; detachment of vascular connexion predisposing to necrosis.

(3) The *extent of bone* to be removed must be determined by observing the appearances of disease, compared with healthy bone, as discovered during the operation of excision. Hence, this kind of operation may be a piecemeal proceeding; as not unfrequently, in the elbow-joint. But, the results of reparation, in the production of osseous thickening, spiculated or nodular enlargement, must not be confounded with the results of disease. In *growing* long bones—*i.e.*, in young persons, joint-excision should not extend beyond the epiphyses, or at least the epiphysal cartilages, in the ends of bone, on which the further longitudinal growth of the bone—and thence of the limb, depends. The *sections* of bone should be parallel, so that the opposed osseous surfaces may be adjusted in apposition; a rule particularly important when osseous union is required, as in the knee.

(4) Skin, and subjacent integument, exclusive of thickened synovial membrane, rarely need be removed; the soft parts recovering a healthy state, and covering from exposure the ends of bone.

(5) *Hæmorrhage* may be arrested by torsion of the arterial vessels; ligature is rarely if ever requisite. Sponging with cold water will arrest any oozing hæmorrhage, and wash away any adherent particles of bone, or clots.

(6) The *ends of bone* must be placed in apposition, but not absolute contact—particularly when ligamentous union is required, as in the hip or elbow.

(7) The *attitude of the limb* must have regard to its functional uses, after excision of the joint. Thus, in the lower extremity, the hip-joint, and the knee, should be straight, for support of the trunk and for progression. In the upper extremity, the elbow-joint should be semi-flexed, to prevent osseous union, and to provide for the relative movements of the forearm and hand.

(8) *Retentive appliances* must have regard to the necessity, or otherwise, for a *fixed* position of the limb; according as the union required is osseous or ligamentous. A suitable splint or splints and bandaging must be applied, so as to prevent the liability of movement, in the directions of displacement peculiar to the joint, after excision; leaving the operation-wound accessible for dressing. This principle of treatment will be fully illustrated by the retentive appliances proper for each particular joint.

Finally, the *line of incision* is brought together and closed by sutures of silk or silver wire; care having been previously taken, at the very last, to see that any clot be washed out, and that the ends of bone are in apposition. Strips of lint soaked in water or weak carbolic lotion, are applied to the wound, and overlaid by a large piece of oil-silk; a bandage being applied over all, to further exclude the air, and maintain some compression for a time, to prevent oozing secondary hæmorrhage.

The *After-treatment* of Joint-Excision, is *local*, as relating to the process of union-integumentary, and between the ends of bone; and *constitutional* treatment, principally hygienic, as relating to the maintenance of



reparative power; both aspects of the treatment having regard also to occasional complications.

(1) Local after-treatment may be reduced to certain rules.—The integumentary wound undergoes more or less tumefaction, but it generally heals by the first intention—primary union taking place along the line of incision; except at its angles, which continue to discharge, slightly perhaps, a puriform matter, or lymph, when the ends of bone have long since united. The *first dressing* need not be removed, usually for 48 hours; then, the wound is to be cleansed, and similar dressing reapplied, the bandage being omitted, or applied lightly as inflammatory swelling supervenes. The *sutures*, some or all, may be allowed to remain for a week or ten days. The *retentive apparatus* should not be removed and reapplied for the first month after excision, unless absolutely necessary to correct some important displacement of the ends of bone. If osseous union be required this rule is the more imperative. The splints are reapplied at the end of another month, and so on; about three re-applications only being permitted in the course of osseous union, as of the knee-joint; while the splint may be abandoned, at a more early period, and passive motion commenced, when ligamentous union is required, as in the elbow. A starched bandage may be substituted for splints, when osseous union has become sufficiently firm; and thus enable the patient to get about and regain his general health. *Secondary hæmorrhage*, a rare complication after joint-excision, can generally be arrested by the ice-bag, or irrigation, aided by the compression of a bandage; and I have only once had occasion to reopen the wound to secure a bleeding vessel—and that in the knee-joint.

*Re-excision*, and *amputation*, will severally be considered in speaking of the different joints.

(2) Constitutional after-treatment should be equally free from the imputation of unnecessary interference. Guided by ordinary principles, little medicine-giving will be needed; the face gradually acquires a remarkable pallidity or sallowness, more than can be accounted for by the comparatively slight loss of blood at the operation; but this appearance wears off, under the influence of quinine and iron with a nourishing diet; the patient—supposing an excision in the lower limb, can often recline on a back-support in bed, so as to be enabled to read or write, or, if a female, amuse herself with needlework; and eventually, before leaving the bed, our patient has become the picture of health.

On the other hand, certain constitutional *complications* are apt to arise after excision, which are of an adverse, or even fatal, character. *Prolonged sickness* from the influence of chloroform, may be subdued by the hypodermic injection of morphia, in one-sixth of a grain doses, while life is supported by nutritive enemata. *Painful jerkings* of the limb; especially in young hysterical subjects, or in consequence of the attrition of the osseous surfaces, is another untoward event, which may be subdued in like manner. *Acute inflammatory fever* may arise, almost immediately after excision, especially in young subjects; but this subsides, or yields to ordinary treatment. *Pyæmia*, I have never yet known to occur after joint-excision. Severe rigors and acceleration of pulse, I have seen arise from attrition of the ends of bone; and in consequence of readjusting the splints, a month after excision of the knee-joint. But this paroxysm usually passes off. *Tetanus* has ensued in only one of my cases,—a knee-joint excision in a young girl of sixteen, and with a fatal result; the only death I have yet had after any joint-excision. *Echæm-*

tion, in consequence of prolonged suppurative discharge, is apt to ensue in scrofulous patients; and this complication will probably lead to re-excision, or amputation instead, or subsequent to this resource. Such cases of secondary amputation are often remarkably successful, in saving life, albeit the limb is sacrificed.

*Repair after Excision.*—Joint-Excision may not be followed by any process of reparation, the ends of bone remaining ununited, as in ununited fracture. Reparation ensues more commonly, however; and the process consists in the production of a substitute-tissue between the ends of bone, forming an intermediate union; which may be, either fibrous and flexible—as a ligamentous connexion, or an osseous and immovable union. *Ligamentous* union is accompanied with an adaptation of the ends of bone to each other, forming a new joint; as after successful excision of the elbow, an instance of which will be described subsequently, from a case recorded by Mr. Syme. *Osseous* union would appear to result from a transformation of the fibrous tissue by a species of ossification; but associated with the production of true cartilage, in the form of nodules, which as centres of development, also undergo ossification. How far the union may become, properly speaking, osseous, attaining to the minute structure of true bone, observations are wanting to determine. Any remaining portion of the original articular cartilage, after a partial excision, is not continuous with but quite distinct from the newly-produced ossifying cartilage; and the former undergoes fatty and fibrous degeneration, thus losing its cartilaginous appearance. The muscular attachments which had been severed by the osseous excision, probably regain new connexions around the united ends of bone; the tendon of the quadriceps extensor muscle, for instance, acquires an insertion into the end of the femur; while the soft parts around the joint become more or less thickened and indurated. Thus then, the union is fortified, and the limb adapted to resume its functional use.

This description of the process of osseous union accords with what was found to have taken place after excision of the knee-joint, in one of my cases, which was subjected to amputation in St. George's Hospital, ten months after the operation on the joint. The result of examination is given, as "repair after excision," in the Catalogue of the Hospital Museum; and a report also, in the Path. Soc. Trans., vol. xii. But the opportunities for such examination are necessarily few; in most cases, amputation of the limb is resorted to only when no appreciable reparation has commenced. The chief source of reparation is also uncertain. Ollier's observations, with those of Maisonneuve, show the importance of the periosteum, as the most active organ in osseous repair, rather than the bone-tissue or even the medullary membrane, and as being far more productive than the surrounding texture. The same relative importance, therefore, may be attributed to the periosteum in the process of repair after excision. Accordingly, I always carefully avoid detaching this membrane, and its vascular continuity with the textures around the ends of bone, which should be left embedded up to the surface of section.

*Excision compared with Amputation.*—Amputation of a limb is generally compared with excision of a joint for disease, as if the two were alternative operations. Now, the incurability of joint-disease by non-operative treatment is indeed the condition eligible either for excision or for amputation. But in what does such incurability consist? The whole diversity of opinion and experience among Surgeons in regard to the propriety of excision *versus* amputation springs from a twofold view of the

nature of the state in question. Thus, scrofulous disease of the knee-joint may be considered incurable, without operative interference, when the disease has advanced to destruction of the articular cartilaginous surfaces of the tibia and femur without the supervention of anchylosis, so that the joint has become functionally useless; or, the same disease may not be regarded as incurable until it has advanced to a further and even to an extreme state of disorganization—dislocation (partial or complete), abscess, sinuses, profuse and long-continued discharge, with the constitutional disturbance of hectic and exhaustion. The turning-point of distinction between these two opposite states of the same disease is this: in the one case the joint has become functionally useless; in the other, to this condition is generally superadded a constitutional state of exhaustion which leaves no period of time nor vital reserve-power sufficient for any prolonged process of reparation after operation—averaging three months for the knee and hip, and six weeks for the elbow.

But this measure of time and of reserve-power are the essential elements of that reparative process which will inevitably be necessary to effect osseous or ligamentous union, as the case may be, and thence a successful result after *excision*. Consequently, compared with *amputation*, the operation of excision, under the adverse circumstances of *advanced* disease, will be singularly unsuccessful; whilst, at an *early period*, recourse to amputation is unnecessary and unjustifiable.

Excision and amputation for joint-disease are, therefore, not alternative operations for the Surgeon's choice of one or the other. The comparatively early period for excision is too early for amputation, and the comparatively late period for amputation is too late for excision. When either operation becomes justifiable for joint-disease, the other should not be entertained.

The *Natural Cure* by Anchylolysis is the true standard of comparison for joint-excision, which, when successful, also results in Anchylolysis; and such comparison must have reference to the five essential particulars already mentioned (p. 607), and to the mortality.

The following *general results* of excision and their relation to conditions of disease of the joints, as illustrated by my own series of cases, may be here noted:

1. *Excision* proved successful by one operation, in 21 out of 25 cases of the knee, hip, and elbow-joints.

2. Of the 4 unsuccessful cases by one operation, 3 were cases of *scrofulous* disease, and of the knee-joint in a total of 12 cases; the remaining 1 being chronic synovitis, and of the elbow-joint in a total of 5 cases.

3. *Re-excision* was resorted to in 2 of the 4 cases; 1 knee-joint, and 1 elbow-joint, the latter with a successful result.

4. *Secondary amputation* in 3 of the 4 cases. All 3 were knee-joint cases, and subjects of scrofulous disease; 1 had been subjected to re-excision. The 3 amputations made *rapid recoveries*. These results tend to show that if the attempt to preserve a limb by previous excision, and even by re-excision of a large joint as the knee, should fail, the operation is not prejudicial to secondary amputation for the preservation of life.

5. *One death* only in the 25 cases, of the knee, hip, or elbow-joints, whatever had been the condition of disease, subject to the principles of selection laid down; or whatever the operation; excision, re-excision, or secondary amputation. The fatal case, was after excision of the knee-joint; and the cause of death,—acute tetanus.



**SPECIAL EXCISIONAL SURGERY OF THE JOINTS FOR DISEASE.—THE KNEE-JOINT.**—*The Conditions of Disease Appropriate for Excision.*—The knee-joint, considered in relation to the operation of excision, illustrates the three general rules as to the conditions proper for operation :—Destruction of the articular cartilages, and perhaps dislocation (Fig 243),

FIG. 243.\*



FIG. 244.†



without the supervention of ankylosis, but whilst the constitutional condition has not advanced to hectic and emaciation; ankylosis of a nature inappropriate to the functional use of the limb—namely, here, ligamentous union; or such ankylosis, coupled with malposition of the limb (Fig. 244) by retraction and dislocation.

But there are also certain *peculiar* conditions as pertaining to the knee-joint which more especially determine the propriety of excision.

(1) Compared with other joints, a certain *limit to the extent* of disease is essential to success. The disease must not extend in either the femur or the tibia beyond the limits requisite for the formation of sufficiently wide-based osseous surfaces to permanently support the weight of the body, and for the preservation of a sufficient length of limb to be really useful. The *patella* should always be removed, as being diseased in some cases, and always useless as a remnant after excision of the joint.

(2) In *young* subjects—under the age of about ten or twelve years—it is of importance that the disease should not extend beyond the limits necessary for the preservation of the epiphyses or of the epiphysal cartilages; the integrity of the latter, at least, being requisite for the subsequent growth of the bone, and thence of the limb, in length. The observations which led to this rule were originally made by Professor Humphry, of Cambridge.

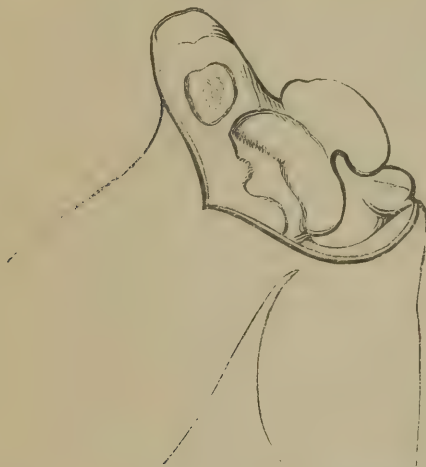
\* Case 12 in my Series.

† Case 13, not included in the Series. In these, and all the Cases, the wood-engravings were drawn by Mr. C. D'Alton, from photographs.

*Operation.*—Excision of the knee-joint for disease, originally introduced by Filkin, of Northwick, in 1762, was followed by Park, of Liverpool, as an independent originator, in 1781; but the operation, performed by Syme in 1829, and on the Continent by Heyfelder in 1849, was revived by Sir William Fergusson in 1850, and followed immediately by Jones, of Jersey, and Mackenzie, of Edinburgh.

The patient lying recumbent, and under the influence of chloroform, the limb, already bent by retraction of the leg consequent on the joint disease, is firmly held by an assistant so as to present the knee vertically; his one hand grasping the thigh, the other hand the leg, the foot of which rests on the table. The knee-joint is most conveniently laid open for excision by a curved horseshoe-shaped incision (U), extending from the

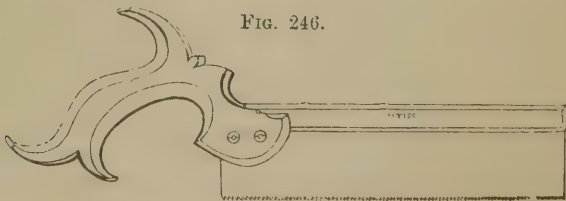
FIG. 245.



side of one condyle downwards across the head of the tibia, just below its articular surface, to the same point on the side of the opposite condyle. Thus both ends of bone are exposed. A second sweep of the knife, dividing the ligamentum patellæ, will fairly enter the joint from side to side, when a touch or two over the remains of the crucial and lateral ligaments completely lays it open; the joint being at the same time forcibly flexed by the assistant. (Fig. 245.) In young subjects, with fibrous ankylosis, care must be taken to sever any such union with the knife, lest by forcible flexion either epiphysis become attached—an accident, in regard

to the tibial epiphysis, which happened in one of my own cases, and which my friend Mr. Bloxam, of St. Bartholomew's Hospital, has seen occur in two more. The joint having been laid open, I raise the flap of integument with my left hand, hooking my fingers under the patella, and, taking particular care not to detach the integument from the femur, I draw the knife across just above the articular end of bone, so as to define it for excision. The saw, a small, broad-bladed one (Fig. 246), is applied in this line, at a right

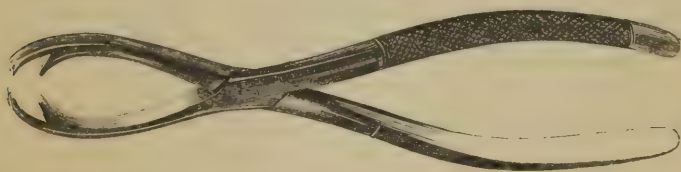
FIG. 246.



angle to the bone—observing to make allowance for the projecting direction of the articular end—upwards and forwards, in the flexed position of the limb, as held by the assistant. Unless this direction be observed, the section

of bone will be oblique to the shaft. A few *strokes* with the saw *brings* its edge out just behind the condyles of the femur, and corresponding to the posterior margin of the articular surface of the tibia; when a slight jerk outwards of the blade detaches the section, exposing a broad, flat, osseous surface on the end of the femur. The popliteal vessels and nerves are quite out of the way in making this section, the saw inclining forwards almost parallel with them, and the ligamentum posticum intervening. To make the tibial section, I apply the saw similarly in front of the head of the tibia, on the margin of the line of incision about half an inch below the articular surface, no detachment of the integument being necessary for this purpose, and carry the blade, at a right angle to the bone, or parallel to the articular surface, so as to bring the edge out about half an inch below it posteriorly; when a jerk upwards with the blade will detach the articular end without touching the ligamentum posticum, or endangering the popliteal vessels and nerves, and a broad, flat, osseous surface is exposed. Sometimes, the "lion-forceps" (Fig. 247), devised by Sir W.

FIG. 247.



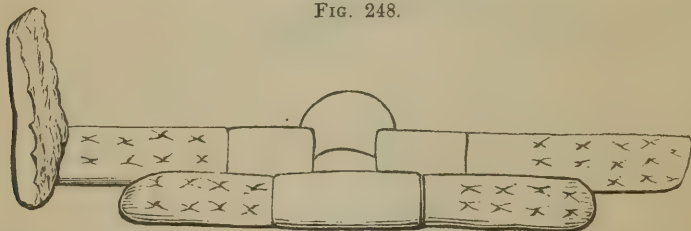
Fergusson, is a useful instrument for the purpose of grasping firmly and holding steadily either articular section of bone, when nearly detached by the saw. And, this instrument may be equally serviceable in other joint-excisions. If the tibial section were made from *behind* the articular surface, and the femoral section also, as some Surgeons practise the operation, the popliteal parts would indeed be quite out of the way; but the ends of bone are thus apt to be detached from their vascular connexions, and the femoral section, as made from the front, is perfectly free from any risk, while the tibial section can be safely made with the little precaution already observed in using the saw towards the posterior ligament. But the liability of wounding the popliteal artery, either with the knife or the saw, should not be overlooked, that accident having happened in at least two instances, one of which was, however, a re-excision wherein the adjacent parts were somewhat affected by adhesion; yet, still to inculcate caution, this accident happened in the hands of a most skilful and practised operator. In the event of such a mishap, amputation must be performed forthwith. Excision of the joint may be performed in a *block*, instead of by separate section, when the articular ends of bone are firmly ankylosed; the piece of bone cut out having a **V** shape, owing to the projection of the knee forward from constant retraction of the leg.

The parallel surfaces of bone, thus made in either way, lie in parallel apposition when the limb is extended. This is the most important operative consideration with relation to the formation of firm osseous union. An oblique direction of either surface is most unfavourable to this result; too much space intervening at one part for the formation of an intermediate plate of bone, and the remainder of the surfaces being tightly locked, the limb cannot be flatly extended; painful startings of the limb



ensue from attrition of the surfaces in contact, and no intermediate plate of bone can be produced. Thus the union would be in part imperfect or ligamentous, and in part incomplete or wanting. A second section must be made from either end of bone, if necessary, to reach a healthy surface, or gouging may be requisite; but the extent of bone excised should be limited by the considerations already explained, and the surfaces must always be finished off *parallel*. The patella is removed, avoiding the making of a button-hole in the integument. Any thickened synovial membrane, often slate-coloured, may be dissected out. Hæmorrhage is easily arrested by torsion of the articular arteries, or any other small bleeding vessels. In scrofulous caries little difficulty is experienced. In chronic synovitis the bleeding is sometimes profuse, owing to the vascular and thickened state of the synovial membrane, and the bone remaining healthy and florid. But torsion, sponging with cold water, and exposure, will still prove sufficient to stop the hæmorrhage. I then extend the limb, and having seen that the ends of bone lie in even apposition—not absolute contact—a flat piece of sponge is held on the wound while the splints are applied. The extended limb is laid on a padded back-splint covered with oil-silk under the knee, this splint reaching from the fold of the nates to just above the heel. (Fig. 248.) I *now* prefer to have the foot-piece part of the lateral splint, as thus the heel escapes pressure and a consequent

FIG. 248.



tendency to sloughing. McIntyre's splint I have long disused: it not only causes some pressure on the heel, and precludes access to that part for dressing, if requisite, but the trough in which the limb lies induces more wasting of the muscles than would otherwise ensue, and thence also a loosening of the splint at an earlier period than when it may be safely removed for cleansing, and reapplied. Broad strips of adhesive plaster are drawn round the limb and splint, immediately above and below the knee, another broad strip high up on the thigh, and narrow strips around the ankle and instep. A roller bandage is applied from the foot upwards, and another high up from the thigh downwards, leaving the knee uncovered. An outside interrupted splint, well padded, and covered with oil-silk above and below the interruption at the knee, and provided with a vertical foot-piece, is now applied; this splint reaching from above the great trochanter downwards, and the end of the thigh-piece well supporting the very *end* of the femur externally, at the seat of excision, while the perpendicular foot-piece maintains the leg in position, and the upper end of the tibia in steady apposition with the femoral end of bone. Elevation of the whole limb five or six inches will be found to further aid the latter purpose. A short padded femoral splint may also be placed in front of the thigh, terminating just above the femoral end of the bone; but if the external thigh-piece be not *too wide*, this anterior splint will

scarcely be necessary, and I rarely use it. The external splint is secured by a roller bandage from the foot to below the knee, and by another bandage from above the knee, up the thigh, and over the end of the splint, with perhaps two or three turns around the pelvis. The use of the external splint is to counteract the tendency to displacement of the lower end of the femur, in three directions, after excision of the knee-joint—projection outwards by abduction, rotation outwards, and projection forwards.

The first two displacements give the characteristic bow-legged and twisted appearance which, in a greater or less degree, is so common in the course of union after knee-joint excision, and both of which proceed apparently from muscular action; while the tendency to projection forwards seems to be produced by a constant sinking of the buttock in bed, thus tilting the lower end of the femur forwards. The side-splint specially counteracts all three displacements; the thigh-piece corresponding in length and breadth with the femur, any tendency outwards is prevented; while eversion and forward projection are restrained by the bandage, and the latter displacement by the support of a firm mattress, or at least a pillow under the buttock. I have had occasion to lengthen this side-splint up to the axilla, so as to counteract a tendency to an angular twist of the trunk to the opposite side in bed; whereby the lower end of the thigh is abducted or everted, with an angular projection outwards at the knee. But there is no tendency to abutment inwards, and no occasion for the application of an internal splint, as practised by some Surgeons. Such a retentive appliance after knee-joint excision is the precaution of a blind timidity, not that which a due knowledge of the possible displacements would suggest.

Lastly, the sponge is removed from the excision wound, any clot wiped out, the ends of bone finally seen to be in apposition, and then the flap of integument closed down evenly by points of suture. Strips of lint soaked in carbolic acid lotion (1 part to 40) are laid over the line of incision, and a broad piece of oil-silk over the whole knee; over all a roller bandage is applied to further exclude the air, and maintain some compression to prevent oozing and secondary hæmorrhage. The patient is removed to a bed close at hand, the limb elevated on pillows to a height of about six inches, and a cradle placed over the excision.

*After-treatment* should be conducted in accordance with the general principles common to all joint-excisions. But I would urge the importance, with reference to the after-treatment of knee-joint excision in particular, of one rule: not to reapply the splints before the end of a month or six weeks, unless absolutely necessary to correct some important displacement. At that time, having removed the splints and gently raised the limb, I sponge it with a spirit-wash, which both cleanses, and fortifies the skin against the tendency to abrasion from pressure. This must be guarded against in reapplying the apparatus. At the end of another month's interval—the second month—on removing the splints, I gently test the progress of osseous union, by placing my finger over the line of union, and slightly moving the lower end of the leg up and down; the long leverage rendering any degree of movement at the union perceptible to the finger so placed, and even to the eye as a sort of hinge-motion. This test is far more delicate and painless than by grasping the limb above and below the knee, and moving it backwards and forwards; however gently that manipulation may be performed. At the end of the third

month, on removing the splints, the trial of union may be made, by seeing whether the patient can himself raise the limb a little from the bed, by its own muscular action. If so, a starched bandage may be applied, provided with a back-splint, and an external splint, of pasteboard; and the limb being slung from the neck by a long loop of roller-bandage, the patient may be allowed to get about on crutches to completely regain his general health. Apertures should be left in the starched bandage, opposite either end of the incision at the knee, where a small sinus-opening, at both points, often exists; and which may continue to weep for a considerable time. Don't probe these little openings. Any necrosed spiculum of bone will work its way out. Any subsequent displacement can be rectified before union is maturely consolidated; and the limb should be very gradually brought into use, for support and progression.

*Results of Excision of the Knee-joint in relation to Natural Anchylosis.*—The true comparison of joint-excision is with the natural cure by ankylosis. Such comparison would involve several essential particulars: the appropriate nature of the ankylosis, and with a proper position of the limb for its functional use; the duration of the period of recovery; the permanency of that result, and its frequency, as resulting from excision or from the natural cure; and their liability to life, or comparative mortality. Statistical results bearing on these questions, and which shall be sufficiently accurate and comprehensive for comparison, are wanting with regard to the knee-joint, no less than in respect to other joints.

Six valuable cases of knee-joint ankylosis, resulting from disease, without suppuration, have been recorded by Mr. T. Bryant.\* They do not, however, entirely meet the questions which I have suggested, and the limited number of cases do not supply sufficient data for comparison.

The period of natural cure would seem to be very protracted, extending often to five years or more, and even to ten years. Cases of this duration, respectively—not, it must be confessed, of a very inviting and encouraging character—are recorded by Mr. T. Bryant, and by Mr. Hilton as having occurred in their practice for the mechanical cure of knee-joint disease. But even a more important consideration is this, that such protracted recovery is attended with a proportionate reduction of constitutional vigour. Hence, with reference to the question of mortality, operative interference may be too late, or intercurrent disease, consequent on delay, may carry off the patient. In either case death ensues from the prolonged attempt to bring about a natural ankylosis. The patient is killed in the curing.

But this inquiry must be pursued. Its importance cannot be over-estimated, since, even in the advanced state of suppuration, free incisions into the joint may prove successful in terminating the disease, with a moveable joint, or at least with ankylosis—a mode of treatment in aid of the natural cure for which Surgery is indebted to Mr. Gay.

*Excision in relation to Life, or the Mortality after Operation.*—Taking the results of large collections of cases, those also in different Hospitals of the United Kingdom as smaller collections, and from the practice of individual Surgeons as still smaller numbers, three *general* conclusions may be established respecting the rate of mortality from knee-joint excision for disease:—1. A diminished mortality as the operation has continued to be practised. 2. Since the revival of the operation, and more recently, an average death-rate of 1 in 4 or 5 cases. 3. Very different death-rates in

\* Medical Times and Gazette, 1870.



the hands of individual Surgeons, varying from 1 in 2 or 3, to 1 in 12 and 1 in 19, or even less. The conditions of disease, both local and constitutional, in the cases selected for operation, have doubtless mainly determined this different resulting mortality, and not unimportant has been the mode of performing the operation, and more significant the after-treatment. But the operation and after-treatment in the particulars essential to success have, perhaps, chiefly affected the resulting state of the limb. The general results respecting the mortality of knee-joint excision for disease in large collections of cases, and those of different Hospitals in the United Kingdom during a period of the last five years, are exhibited in the following collections of cases, which illustrate the three general conclusions already referred to.

For the special returns relating to Hospitals (and to individual Surgeons), I am indebted to those whose names are stated below.

It is scarcely necessary to observe that, of the large total number of cases, some are necessarily included in more than one collection.

1. Collected by Mr. Butcher. Period 1850-54: Number of cases, 31: recoveries, 25; deaths, 6 (mortality, 1 in 5). Period 1854-56: Number of cases, 50: recoveries 41; deaths 9 (mortality, 1 in 5 or 6).

2. Collected by Mr. Price; period 1760-1860, extended by Mr. H. Smith to 1865.—Number of cases, 316: recoveries, 240; deaths, 76 (mortality per cent., 24·05, or 1 in 4). Amputations after excision, 39: recoveries, 30; deaths, 9.

3. Collected by Dr. MacCormac.—Number of cases, 74: recoveries, 49; deaths, 25. Amputations after excision, 11: recoveries, 7; deaths, 4.

4. Collected by Mr. W. P. Swain.—Number of cases, 82: recoveries, 67; deaths, 15. Amputations after excision, 4: recoveries, 4; deaths, 0.

5. Collected by Dr. R. Hodges.—Number of cases, 208: recoveries, 106; deaths, 60 (mortality per cent., 28·84, or 1 in 3 or 4). Amputations after excision, 42: recoveries, 7 (?); deaths, 9.

6. Collected by Heyfelder.—Number of cases, 213: recoveries, 149; deaths, 64.

7. Collected by M. L. Peniere (British and foreign); period 1762-1869.—Number of cases, 431: recoveries, 300; deaths, 131, including 47 amputations and 6 re-excisions.

#### *Author's Collection.*

1. King's College Hospital; period 1850-70. (Per Mr. H. Smith.)—Number of cases, 80: recoveries, 57; deaths, 23. Amputations after excision, 8; recoveries, 4; deaths, 4.

2. St. Bartholomew's Hospital; period 1866-70. (Per Mr. Callender.)—Number of cases, 37: recoveries, 28; deaths, 9. Amputations after excision, 3: recoveries, 2; 1 death.

3. Royal Infirmary, Edinburgh; period, 1865-9. (Per Mr. P. H. Watson.) Number of cases, 32: recoveries, 18; deaths, 14.

4. St. Thomas's Hospital; period 1866-70. (Per Mr. F. Churchill.)—Number of cases, 22: recoveries, 14; deaths, 4. There was one amputation after excision, which resulted in death. (Four cases under treatment.)

5. Royal Free Hospital.—Number of cases, 20: recoveries, 18; deaths, 2. Amputations after excision, 6, of which 3 were re-excisions; recoveries 6.

6. Chalmers Hospital, Edinburgh; period last six years. (Per Mr. P. H. Watson.)—Number of cases, 18; recoveries, 16; deaths, 2.

7. Royal Sea-Bathing Infirmary, Margate; period, last five years. (Per Mr. J. R. Clouting.) Number of cases, 13; recoveries, 10; deaths, 2; re-excisions, 2, no improvement. In 1 case, result not stated.

8. Charing Cross Hospital; period 1870. (Per Mr. Hancock.)—Number of cases 11: recoveries, 11 (?).

9. Royal Infirmary, Liverpool; period last five years. (Per Mr. W. J. Cleaver.)—Number of cases, 11: recoveries 10; 1 death. Amputations after excision, 3: recoveries, 3.

10. Westminster Hospital; period last five years. (Per Mr. F. Mason.)—Number of cases, 10: recoveries, 8; deaths, 2. There was one amputation after excision, which recovered.

11. London Hospital; period last five years. (Per Mr. M'Carthy.)—Number of cases, 8: recoveries, 5; deaths, 2; 1 progressing favourably.

12. Royal Albert Hospital, Devonport; period last five years. (Per Mr. W. P. Swain.)—Number of cases, 6: recoveries, 6. One amputation after excision, ending fatally.

13. Great Northern Hospital; period last five years. (Per Mr. J. Willis.)—Number of cases, 4: recoveries, 2; deaths, 2.

14. St. Mary's Hospital; period last five years. (Per Mr. Gascoyen.)—Number of cases, 2: 1 recovery; 1 death.

15. Guy's Hospital; period 1864–69, or five years. (Per Mr. T. Bryant, from Dr. Steel, Superintendent.)—Amputations after excision, 4: recoveries, 3; 1 death.

*Comparative Mortality of Excision, and Amputation in the Thigh.*—The results of thigh-amputation for disease, as noted in University College Hospital, are thus stated by Mr. Erichsen. Of 34 cases of such amputation, 7 died; or say 1 in 5—a mortality of 20½ per cent. Malgaigne's statistics from the Parisian Hospitals show a far higher mortality: in 153 cases of thigh-amputation for disease, 92 died, being a mortality of 60 per cent. Mr. Syme represents the mortality as yet higher—from 70 to 80 per cent., taking amputations of the thigh generally. Approaching larger masses of results, we find that in Mr. T. Bryant's collection of 1168 cases of thigh-amputation, 254 died, or 21·7 per cent.; and in Carrick's still larger collection of 1413 cases, 434 died—a mortality of 30·71 per cent., or 9 per cent. higher mortality than in the former series. These large collections of cases, however, are indiscriminate. They include excisions for injury as well as for disease, and the latter not exclusively such as might be eligible for excision. But Mr. Bryant has supplied 188 cases of amputation of the thigh for chronic disease of the knee-joint; and of these there were 41 deaths—1 death in between 4 and 5 cases, or a mortality of 21·8 per cent. This nearly corresponds to the death-rate first stated; and it about equals the death-rate after excision. But if the mortality of thigh-amputation, and of excision of the knee-joint, both for disease of the joint, be thus about equal, the patients who survive either operation have a very different advantage; the one being without a limb, the other with the limb preserved.

*State of the Limb.*—The functional result of excision, whether of the knee-joint or other joints, is generally expressed in rather vague terms—*e.g.*, useful limb, without specifying the kind of union, or the position of the limb, as straight or bent. This indefinite mode of record omits much satisfactory information as to the state of the limb after operation. As a

specimen of the average record of results under this head, I may cite from Mr. Butcher's collection of cases referred to in considering the relation of knee-joint excision to the mortality after operation. Of the 25 recoveries, out of 31 cases, 17 were enabled to walk about with "perfect use" of the limb. Of the 41 recoveries, out of 50 cases, 33 had "useful limbs," the remaining 7 being subjected to amputation.

Compared with the stump after amputation, Sir William Fergusson justly observes:—"A well-healed stump never in reality improves, unless, possibly, it gets more callous, whilst often it gets more tender and irritable; but the seeming perfect result of excision at the end of six or twelve months, just when stumps are generally at the best, is no criterion of true perfection. If the limb is properly managed afterwards, it goes on improving for months—ay, for years. The thigh, leg, and foot enlarge in bulk; and in particular, with this change, the leg and foot improve in muscular energy." But why draw any further comparison between a stump—a truncated limb, and a slightly shortened limb, even although the stump be fitted and set off with an artificial leg?

The *average duration* of the progress of recovery is considerable. According to Dr. Hodges' tables, the duration of treatment, when the patella had been removed, in 48 cases, was 225 days; and when that bone is believed to have been left, in 38 cases, this period extended to 255 days. The average duration, therefore, was about eight months. But in 8 successful cases, all of them children, at St. Thomas's Hospital, the average duration of treatment, as reported by Mr. Allingham, was only 206 days, or about seven months. Many cases also progress more rapidly than this; and in my first case of excision of the knee the period of osseous union was only 60 days, or two months, the knee then supporting the weight of the trunk. This patient was thirty-three years old at the time of operation, with previous synovial disease of six years' duration; and the union has stood the test of twelve years' free use of the limb. The *average period* for recovery, in my own cases, has been, for the production of firm or perhaps osseous union, three months; and to regain a useful limb, three months more, in a starched bandage, with gentle use of the limb gradually, for support and progression. Subsequently the limb will regain bulk and strength by increasing muscular development.

The *permanent character* of a successful result after excision, and the *average frequency* of such result, are questions severally omitted from statistical records. Both these important elements are noted in the results of my own cases. (See *Analysis*, p. 629.)

The *growth of the limb* in length, after excision of the knee-joint, is a question respecting which the results are conflicting. The question can only affect the propriety of this operation in *youth or childhood*. It was originally suggested and investigated by Professor Humphry, of Cambridge, in an admirable paper on the Growth of Bones in their Long Axis at their Epiphysial Cartilages. The two epiphyses—upper and lower—in a long bone are not equally productive of its longitudinal growth; one is a more active organ of growth than the other. In the tibia and humerus the upper epiphysis is thus more important; in the femur and radius, the lower epiphysis. But the lower femoral epiphysis would appear to be *relatively* more important to the longitudinal growth of the femur than the upper tibial epiphysis is to the elongation of the tibia. Hence, with reference to excision of the knee-joint, removal of the *femoral epiphysis* will more especially arrest the subsequent growth of the



limb in length. The growth of the *foot* also is arrested, so that it may become insufficient to sustain the weight of the body. All this arrest of development may be reduced still further by the imperfect growth from previous disease.

The practical deduction, therefore, seemed to be, that if, by excision of the knee in a growing subject, the epiphyses and epiphysal cartilages of the tibia and femur be removed, this operation will *invariably* tend to arrest the growth of the limb subsequently. Mr. Pemberton, of Birmingham, followed, in 1859, with a case in which a youth, having been operated on in 1854, the limb in 1859 was nine inches shorter than its fellow. Another case, from the practice of Dr. Keith, of Aberdeen, showed a deficiency in length of five inches during six years' growth. Counter-evidence on this question is adduced by Mr. Butcher. Dr. Keith himself wrote to the latter eminent Surgeon, in 1856, that "J. Hay's limb, operated on November, 1853, is plump, and growing in length as fast as his sound limb. So also is J. Keith's, operated on May, 1854." Corroborative cases are cited from reports by Mr. Page, of Carlisle, and Mr. Brotherston. In a case where the entire epiphyses were removed by Mr. C. Heath from the knee-joint of a boy aged eleven years and a half, subsequent measurements showed that the *loss* of growth in length of the limb, was only two inches in five years and a half. This case also illustrated the fact that such arrest of growth depends more on the removal of the lower epiphysis of the femur than the upper epiphysis of the tibia, the one bone growing in length more than the other after removal of its epiphysis at the knee-joint. Thus, the femur, as compared with its fellow, had lost four inches; the tibia, compared with its fellow, had lost only half an inch,—making an absolute difference in the whole length of the limb of four inches and a half.

Still, allowing for these and other exceptional cases, the rule already laid down as to excision of the knee-joint in young subjects, under the age of about ten or twelve years, should be observed.

*Re-excision.*—This proceeding is particularly advocated by Sir William Fergusson. In his "Lectures on the Progress of Surgery" he urges re-excision after a fair trial of the result of the original operation. Then he observes: "I believe dealing freely with the wound, opening sinuses, clearing away strumous effete material, picking away loose necrosed pieces of bone, gouging away bare material of the kind—ay, even opening up the whole surfaces, and sawing off fresh pieces of bone, to be better than amputation." My own experience of re-excision, as to the knee-joint, may be thus summarily stated. In 12 cases of knee-joint excision, 1 was followed by re-excision, and 3 by secondary amputation, but with a recovery so rapid as seemed to indicate that neither of the previous operations, excision or re-excision, was prejudicial to secondary amputation for the preservation of life.

*Secondary Amputation.*—The probability of amputation becoming necessary after knee-joint excision is a question that may be determined by reference to the collections of results which I have brought forward, and which show also the mortality thence ensuing, in *addition* to the proportion of deaths arising from the operation of excision. Of the 7 cases alluded to in Mr. Butcher's report as having been subjected to amputation after excision had apparently failed, 6 recovered rapidly, and only 1 died. In my own cases, of 12 knee-joint excisions, 3, including the 1 re-excision case, were submitted to amputation, and all made rapid recoveries. Compared with *primary* amputation of the thigh for disease of the knee-joint,

these results as to mortality are most gratifying, and without at once sacrificing the limb which might yet be preserved by excision. Thus, in addition to the statistics already quoted, the mortality of primary amputation formerly at St. George's Hospital, as practised for "abscess" and "ulceration of the articular cartilages," was most melancholy. Of 11 such amputations of the thigh at that Hospital, as reported in the *Medical Times and Gazette* (1856), 5, or nearly 50 per cent., of the patients died, while 1 of the remaining 6 was convalescent only on the sixty-second day.

**TYPICAL CASES OF KNEE-JOINT EXCISION.**—In proceeding to record the essential particulars of my own series of knee-joint cases, it seems desirable to take them separately from the records of previous experience, in order to represent this series from two points of view,—firstly, as supplying *typical* illustrations of the conditions of disease, local and constitutional, which are appropriate for excision, and the results, proximate and permanent, of operation in each case, together with any peculiarities; secondly, the cases are submitted to analysis with reference to these, and also any *questions* of secondary importance pertaining to excision of the knee-joint for disease.

Two of the cases were partly narrated in the Hospital Reports of The Lancet of 1860; the remaining ten cases I have abstracted from clinical notes carefully taken by Mr. T. C. Murphy, senior house-surgeon at the Royal Free Hospital.

The first four cases especially illustrate the conditions of disease which I have found to be appropriate for excision of the knee-joint—during the course of disease; in three other cases, 7, 8, and 9, as being failures of the natural cure, both in regard to the kind of ankylosis and by malposition of the limb. The remaining 5 cases are interesting more particularly as exhibiting peculiarities or complications: in one case, albuminuria; in another case, a very early period of life; in another, pregnancy at the time of excision, but safe parturition at the full period, with a living, healthy child, and the mother's limb having undergone firm osseous union; in another, accidental detachment of the tibial epiphysis in the operation; in another, acute tetanus and death,—the only fatal case I have yet had after *any* joint-excision, 28 in number.

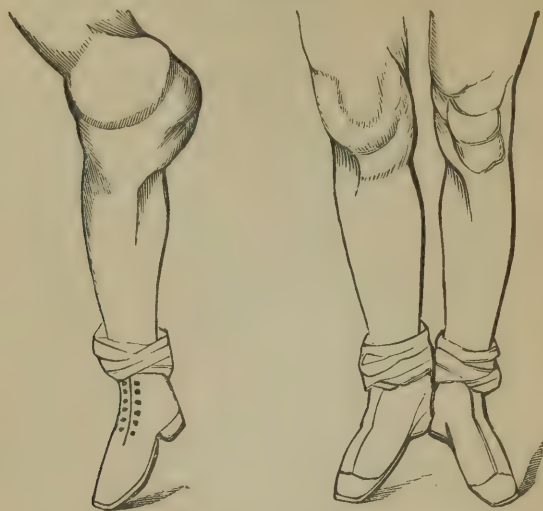
**CASE 1.**—Elizabeth D—, æt. 33, admitted into the Royal Free Hospital on the 12th of September, 1859. *Chronic synovitis* of the right knee-joint, of traumatic origin (Fig. 249); duration of disease, six years; treatment occasionally. *Ulceration* of the articular cartilages, and extensive *caries* of the ends of the femur and tibia. Constitutional condition, nervous exhaustion. *Excision.* *Recovery*, with firm osseous union and a thoroughly useful limb in two months. *Result* known to be permanent after ten years. (See Fig. 249.)

**CASE 2.**—William A—, æt. 27, admitted into the Hospital, July, 1869. *Chronic synovitis* of the left knee, apparently of constitutional origin; five years' duration; four months' treatment. Pulpy thickening of synovial membrane. *Ulceration* of the articular cartilages, and superficial *caries* of the ends of the femur and tibia. Health good. *Excision.* *Recovery*, with firm osseous union and a useful limb in three months. Subsequently, limb slightly bowed.

**CASE 3.**—John P—, æt. 18, admitted into the Hospital Oct. 19th, 1859. *Scrophulous caries* of the ends of the femur and the tibia in the right knee-joint, of traumatic origin; five and a half years' duration; two years' treatment, in five Metropolitan Hospitals. *Partial ulceration* of the

articular cartilages. Hectic and emaciation; this constitutional condition improved by medicine and diet, before operation. *Excision. Recovery*, with union in three months. At another Hospital, apparent recurrence of the disease after ten months. *Amputation*; rapid recovery.

FIG. 249.



CASE 4.—Emily R.—, æt. 20, admitted into the Hospital April, 1869. *Scrofulous caries* of the ends of the femur and the tibia in left knee, of traumatic origin; one year's duration; nine months' treatment. *Ulceration* of the articular cartilages. Health irregular. *Excision. Recovery*, with partly firm union, in three months. Formation of abscesses and sinuses around the callus, and prolonged discharge. *Amputation*, and recovery in a month.

CASE 5.—Sarah A. H.—, æt. 18; admitted into the Hospital, Feb. 2nd, 1869. *Scrofulous caries* of the ends of the femur and tibia, in the right knee-joint; of traumatic origin; twelve years' duration, with occasional treatment. *Ulceration* of the articular cartilages. Marked anæmia. *Excision. Secondary hæmorrhage* next day, suppressed by ice-bag. Displacement and projection of the end of the femur on the fifth day. *Re-excision* of its extremity. *Albuminous urine* supervened in a few days, with marked cachexia and prostration; and *sloughing* of the integument of the calf. *Amputation* in middle third of the thigh. Rapid disappearance of albumen in the urine, and restoration of strength. *Recovery* by primary union, with a perfectly sound stump in one month. About six months afterwards, stump still sound, but the patient was affected with scrofulous conjunctivitis and opacity of the cornea; also complete deafness.

CASE 6.—Elizabeth A. G.—, æt. 5; admitted into the Hospital, July, 1869. *Scrofulous caries* of the ends of the femur and tibia, especially the latter, in the left knee-joint of a child; of supposed traumatic origin; three and a half years' duration, and occasional treatment; *ulceration* of



the articular cartilages. Health good. *Excision* through the epiphyses. *Recovery*, with firm osseous union and a useful limb in four months.

CASE 7.—Henry G——, æt. 20, admitted into the Hospital, Oct. 28th, 1869. *Chronic synovitis* of the left knee-joint, of traumatic origin; one year's duration; ten months' treatment. Partial ulceration of the articular cartilages of the femur and tibia, followed by partial *fibrous ankylosis* and retraction of the leg, with *partial dislocation* of the femur forwards. Health good. *Useless tenotomy* of the hamstring muscles. *Excision*. *Recovery*, with a thoroughly firm osseous union and useful limb in two months and a half. *Permanent result*, one year. (Fig. 250.)

FIG. 250.



FIG. 251.



CASE 8.—Henry H——, æt. 17; admitted into the Hospital Nov. 27th, 1869. *Scrofulous caries* of right knee-joint, of traumatic origin; fourteen years' duration, with occasional treatment. Partial ulceration of the articular cartilages of the femur and tibia, followed by partial *fibrous ankylosis* and retraction of the leg, with *partial dislocation* of the femur forwards. Health good. *Useless tenotomy* of the hamstring muscles. *Excision*. *Recovery*, with osseous union and a useful limb in two months. This patient sat up out of bed daily at the end of five weeks. *Permanent result*. Nine months after operation (Dec. 1870) he could stand on the one leg unsupported, and hop on it; just before Christmas he walked from near Gray's-inn-road to Harrow and back—a distance of twenty-four miles—for a day's bird-snaring; and on Boxing-day he was sliding on the ice all day. Continued result, one and a quarter year after operation. (Fig. 251.)

CASE 9.—Thomas W——, æt. 10; admitted into the Hospital, Oct. 1869. *Scrofulous caries* of left knee-joint, of traumatic origin; seven years' duration and equally prolonged treatment, latterly by *extension* of the limb. Partial ulceration of the articular cartilages of the femur and tibia, followed by partial *fibrous ankylosis* and retraction of the leg, with

*partial dislocation of the femur forwards. Health delicate, with constant cough. Excision through the epiphyses. Recovery, with osseous union and a useful limb in two months and a half. Permanent result, one and a quarter year. (Fig. 252.)*

FIG. 252.



CASE 10.—Sarah S——, æt. 20. *Chronic synovitis of the right knee-joint, of traumatic origin, by a fall off a form. Duration of disease, fourteen years. Treatment in two Metropolitan Hospitals at different periods up to fifteen years of age. At both these institutions amputation of the thigh was declared imperative. Extensive ulceration of the articular cartilages of the femur and tibia; limited fibrous ankylosis, with retraction of the leg to an angle of sixty degrees; ankylosis of the patella to the condyles of the femur. Health reduced; pregnancy of one month. Excision. The night of operation, sickness from chloroform. For two days, painful startings and jumpings in the leg of spasmodic character, affecting the knee. Fourth day, an hysterical fit, and the startings were renewed. The usual apparatus—a long back splint, and an external interrupted splint with foot-piece—holds firmly, and no displacement of the ends of bone. Spasms subdued, and sleep induced by the hypodermic injection of morphia—one-sixth-grain doses occasionally. Two months and one week after operation, “quickenings” was first felt. The incision was firmly healed by primary union, and firm ankylosis between the ends of bone progressing. Puffy swelling around knee; reduced by moderate and gradual compression with a many-tailed bandage. On removing the splints, a small ulcer on the heel, and another on the sharp edge of the tibia. Apparatus reapplied, leaving the heel more uncovered, and an opening opposite the tibial ulcer. Under zinc-wash dressings, both sores healed. General health very good; the patient fast regaining flesh and colour, with a bright eye and cheerful aspect—looking, indeed, the picture of health. Recovery, with firm fibrous ankylosis, in*

three months; limb put up in a starched bandage, and the patient allowed to get about on crutches. Shortly after, was discharged from the Hospital. A tendency to bowing outwards of the knee was soon evinced; rectified by gradual manipulation, the imperfectly ossified callus admitting of such *readjustment*, and the starched bandage reapplied. *Parturition* at the full period; the mother and child both having done well. Firm osseous union. *Permanent result*, six months.

CASE 11.—Harriet M——, æt. 16. *Chronic synovitis* of the left knee-joint, of traumatic origin,—by a fall, and many years afterwards, by a puncture-wound with a crochet-needle two inches in depth, penetrating the joint. *Duration* of disease, thirteen years from first injury, six months from the second. *Treatment* commenced three years ago, continued for one year in a Metropolitan Hospital, then for some time in a special Hospital—where extension was long used without any permanent benefit. *Partial ulceration* of the articular cartilages of the femur and tibia; limited fibrous ankylosis, with retraction of the leg—the toes just touching the ground, and partial dislocation of the femur forwards. *Excision*. Sickness after chloroform. *Acute inflammatory fever* in twenty-four hours. Slight *rigors* on each of the two days following the operation. Third day, copious pink lithates deposit in urine, and subsidence of the fever. Sixth day, slight return of feverishness, and in the evening, *erythematous patches* appeared on the arms, front of chest, and neck, face flushed. This subsided in twenty-four hours, under treatment by bicarbonate of potash and tincture of hyoscyamus. Eleventh day, a *gangrenous patch of skin*, about the size of half-a-crown, in the middle line of the incision, which sloughed away in two days, exposing a portion of the femoral end of bone. All the sutures were now removed. Wound otherwise healthy, primary union taking place except in middle, and, as usual, at the angles. Ends of bone in perfect apposition. Sixteenth day, trismus, followed by full development of tetanus in twenty-four hours. At the end of thirty-six hours, death. Hydrate of chloral had been tried in ten-grain doses, every hour. P.-M. Examination of the joint—Union by tags of lymph, puriform fluid around ends of bone.

CASE 12.—William B——, æt. 9. *Chronic synovitis* of the left knee-joint, of traumatic origin, by a slight blow with a hoop. *Duration* of disease, ten months. *Treatment* in two Metropolitan Hospitals; and then in the Royal Free Hospital—by strapping, &c. Discharged; re-admitted in a month; *extension* by a back splint and screw, continued for five weeks without any effect. *Partial ulceration* of the articular cartilages of the femur and tibia; fibrous ankylosis, with retraction of the leg—the toes touching the ground, and partial dislocation of the femur forwards and outwards. *Excision*. *Accidental detachment of tibial epiphysis*, its removal, with the articular end of the femur through its epiphysis; also the patella. *Recovery* without a bad symptom. *Result*—Period since operation, five months.

ANALYSIS OF THE CASES.—(1) *Conditions of Disease*.—Caries in all cases, with the destruction of the articular cartilages of both the femur and tibia. In Case 1 the femur was chiefly affected, in Case 6 the tibia, and in the other ten cases both bones were about equally affected. The patella was healthy in nearly all cases.

(2) *Commencement of the disease*.—Synovitis in six cases—1, 2, 7, 10, 11, 12; scrofulous caries in the other six cases. *Cause*: Traumatic in eleven cases; constitutional in Case 2.



(3) *Duration of disease, and of treatment previous to operation.*—Case 1: disease 6 years; treatment occasionally. Case 2: disease 5 years; four months' treatment. Case 3: disease  $5\frac{1}{2}$  years; 2 years' treatment. Case 4: disease 1 year; 9 months' treatment. Case 5: disease 12 years; occasional treatment. Case 6: disease  $3\frac{1}{2}$  years; occasional treatment. Case 7: disease 1 year; 10 months' treatment. Case 8: disease 14 years; treatment occasionally. Case 9: disease 7 years; and equally prolonged treatment. Case 10: disease 14 years; treatment in two Metropolitan Hospitals. Case 11: disease 13 years; treatment 1 year in a Metropolitan Hospital, then in a special Hospital. Case 12: disease 10 months; treatment in two Metropolitan Hospitals, then in the Royal Free Hospital.

(4) The constitutional disorder had *not* advanced to hectic and emaciation in any of the twelve cases except in Case 3. In Case 1, nervous exhaustion; 2, health good; 4, health irregular, digestion impaired; 5, marked anæmia; 6, health good; 7, health good; 8, health good; 9, health delicate with constant cough; 10, health reduced; 11, health good; 12, health good.

Pregnancy, without miscarriage, at the time of excision; parturition at the full period, mother and child well; in Case 10.

(5) *Age and sex.*—Age: 33, 27, 18, 20, 18, 5, 20, 17, 10, 20, 16, and 9 years. Sex: six males and six females.

(6) *Operation.*—The *incision* was semilunar downwards from condyle to condyle in all the cases. The *portions of bone* excised were the articular ends of the femur and tibia in all the cases, with additional portions of cancellated bone in Cases 1 and 6. The patella was removed in all cases. The *synovial membrane* was also removed as much as possible in cases 2 and 7 of chronic synovitis. *Hæmorrhage* was inconsiderable during the operation in all the cases, no ligatures were required, the articular vessels being secured by torsion and exposure. *Sutures*—metallic in Case 1, silk in the subsequent eight cases. *Dressings*—water dressing in Cases 1 and 3, weak carbolic lotion in the other ten cases. *Splints*—a McIntyre, or else a back splint with foot-piece in all the nine cases, with an outside interrupted splint in all cases except 1 and 3.

(7) *Primary union.*—Complete, except just at angles of the incision, in Cases 2, 6, 7, 8, 9, 10, 12, or in seven cases; partial in Cases 1, 3, 4, 5, 11, or in five cases.

Secondary hæmorrhage in Cases 3, 5, and 8; arrested by ice in the first case, by ligature in the latter two. Sloughing or ulceration from pressure in two cases, 5 and 10.

(8) *Intervals of removal of splints.*—Average period one month after operation, and at similar periods subsequently; making only three or four reapplications of the retentive apparatus in each case.

(9) *Results.*—Osseous or firm union, and a straight limb, in all the cases; except Case 3, where it was incomplete; Cases 4 and 5, which were subjected to amputation; and Case 11, the *only death*, and from acute tetanus in thirty-six hours, seventeen days after operation. Period of union, average three months. Subsequently the limb slightly bowed in two cases—2 and 6; the latter a child aged five.

(10) *Re-excision* in Case 5—a scrofulous case.

(11) *Secondary amputation* in Cases 4 and 5—both scrofulous cases; also in the questionable Case 3—a scrofulous case.

(12) *Permanent result.*—Ultimate known period: (1) 11 years; (2)

1½ year; (6) 1½ year; (7) 1 year; (8) 1¼ year; (9) 1¼ year; (10) 6 months; (12) 5 months.

Such, then, at present, is the recorded contribution of the Royal Free Hospital to excisional surgery of the knee-joint for disease.

**HIP-JOINT.**—The *natural cure* of hip-joint disease has not yet been investigated in a series of cases, sufficiently accurate and comprehensive, for comparison with the results of excision. Such an inquiry should have regard, (1) to the joint, in respect to five essential particulars—the appropriate nature of the ankylosis, and the proper position of the limb for its functional use, the average duration of the period of recovery, and the permanent character of that issue, with its average frequency; (2) the liability to life or the mortality of the natural cure. It would be from these points of view, as to limb and life, that the results of excision must be compared and its relative value estimated. Pending this clinical inquiry, we may approach the question from our present knowledge of pathology.

What, then, are the changes which the joint and constitution undergo in the course of natural cure by ankylosis? In the joint there is a two-fold process of destruction and reparation. A piecemeal or molecular excision, so to speak, is constantly progressing, apparently by absorption and certainly by the draining away of débris of bone in the discharge until two healthy opposed surfaces are reached, so that union may at length be effected. This natural cure of joint-disease entails a protracted period of recovery, extending even to many years as compared with that of weeks or months required for recovery after excision. During this ordeal the constitutional vigour is reduced, subsequently leaving the patient stamped with the aspect of suffering in former years. Occurring also as it often does during the growing period of life, the reserve power, which should have been gained to meet the exigencies of after-life, is used up prematurely by incessant demand in the long process of reparative ankylosis. Persons who have undergone the natural cure of diseased hip-joint, for example, may be seen hobbling about the streets, being easily recognised by the characteristic gait of old-standing hip disease, and by their sallow and prematurely aged appearance. This constitutional decrepitude may possibly be averted by a remarkable acceleration of the excisional part of the process. In a case represented by specimen No. 7 of the hip-joint series, an eminent Surgeon differed with myself and others respecting its diagnosis; nature subsequently undertook the operation of excision *en masse*, for she severed and discharged the greater portion of the head of the femur through one of the fistulous tracks. This natural excision of a joint—one of the only two, I believe, on record—will be singularly suggestive to operative excisionists, and it should be equally admonitory to those Surgeons who blindly oppose the operation.

*The Conditions of Hip-joint Disease Appropriate for Excision.*—It was formerly held, and may still be maintained by some Surgeons, that Excision of the hip-joint for disease should be resorted to only in the following conditions—constitutional and local:—

(1) Only in the last stage of the disease, or of constitutional endurance.

(2) Only when the extent of disease is limited, the acetabulum being free from disease, and the amount of pelvic disease trivial.

(3) Only when the head of the femur is dislocated.

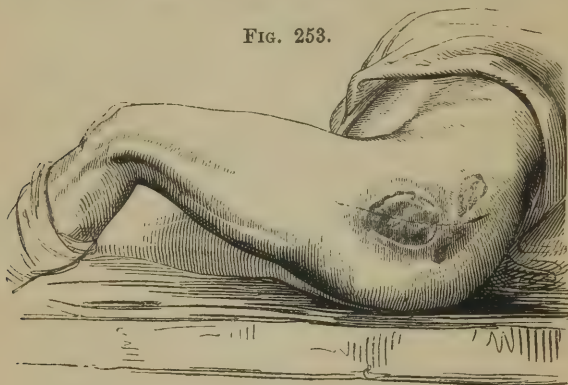
The reverse of these rules or nearly so may be partly gathered from

my cases, and can, I believe, be justified by accumulated experience, drawn from the results of a large but varying number of cases, with regard to each such rule in question.

Of the three conditions laid down respecting Excision of the Joints in general, the first only applies to the hip-joint.

(1) Destruction of the articular cartilages, without the supervention of ankylosis, will always justify operative interference by excision. The constitutional condition will probably *not* then have advanced to hectic and emaciation. (Fig. 253.) But the state of the general health should primarily determine the necessity for excision in all cases, and not any arbitrary consideration of the period of the disease and the condition of the joint. Whenever, therefore, the general health is manifestly failing, whatever may be the stage of the hip-joint disease, excision should be

FIG. 253.



resorted to and without further delay. This guiding rule was strongly urged and clearly illustrated by Mr. Hancock in his recent lectures at the Royal College of Surgeons. On the other hand, the most extreme state of constitutional exhaustion, previous to the operation of excision, may be followed by recovery after removal of the diseased bone; as the successful results in my own series of hip-joint cases, 1, 2, 4, and 6, clearly show.

(2) Osseous ankylosis with mal-position of the limb will *not* justify the peril of attempted excision. Section of the neck of the femur is practicable, whereby the limb can be brought down to a straight position. This principle of operation was lately practised in a case by Mr. W. Adams, and successfully.

(3) The *extent of bone* diseased may be considerable, and involve both the femur and acetabulum. In the *femur* the diseased portion may include the head, neck, great trochanter, and shaft, entering even into the medullary canal. In the *acetabulum* the diseased portion may include the whole floor of this cavity, and even extend to adjoining portions of the ilium, pubis, and ischium. Neither of these conditions of extensive osseous disease prohibits excision; but the acetabulum not unfrequently recovers itself when the diseased head of the femur has been removed from further contact and attrition.

(4) Dislocation is unfavourable for excision, as implying an advanced stage of the disease constitutionally. The significance of this local con-



dition will, therefore, diminish in proportion to the absence of marked hectic and emaciation.

The *evidence* in support of these principles or rules for hip-joint excision is important, seeing that they are at variance, as I have said, with the results of former experience.

Firstly, respecting the *constitutional condition*. Advanced hectic, inevitably consequent on prolonged irritation and suppurative discharge in the last stage of the disease, will evidently have so reduced or exhausted the patient's reserve-power, as to peril the prospect of recovery, although the diseased bone be then removed by excision. The deliberate postponement of the operation until that period when constitutional exhaustion with emaciation is verging on dissolution, would be almost equivalent to operating on a corpse. By analogy, I would liken it to the postponement of operation for the relief of strangulated hernia until the patient is sinking in consequence; the Surgeon deliberately allowing the expenditure of the reserve-power requisite for recovery, without which operative interference must necessarily be a failure and the patient doomed. Hey's maxim respecting strangulated hernia is at least suggestive with regard to excision:—"I have often had occasion to regret operating too late, I have never regretted operating too early." It is no answer to this argument for timely operation as the rule, to point to exceptional cases of successful results at a later period, in the obviously adverse condition of constitutional exhaustion.

*Osseous* ankylosis of the hip-joint, with useless mal-position of the limb, would seem to invite excision, to restore a straight limb and with a moveable joint; but the difficulty of detaching the firmly soldered femoral head from the acetabulum, or the damage done by this procedure, would be such as to render the operation impracticable or fatal. Section of the femur, between the trochanters, or in the neck, has been proposed and practised instead; operative procedures of which I shall have to speak in due time.

Respecting the *extent of bone* which may be excised successfully, this element in the operation of hip-joint excision does not appear among the tabulated particulars of the majority of cases recorded. The portions of bone removed in each of my own cases are stated in the analysis of the series. As to the *femur*, in one case, I excised four and a half inches of the bone,—namely, head, neck, great trochanter, and two inches of the shaft, with about one inch more of the cancellated bone below, thence entering the medullary canal. That is, I believe, the largest femoral portion of bone which has hitherto been removed in any case of hip-joint excision on record. The patient recovered, with a thoroughly useful limb, and permanent result at the end of five years. Sir W. Fergusson removed four inches of the femur in one case.

The *acetabulum* is very rarely the seat of origin in hip-joint disease, yet that portion of the articulation rarely remains unaffected. Of 92 cases, referred to by Mr. Hancock, in only 18 the acetabulum was healthy. But the head of the femur is mostly diseased in a greater degree, it having been entirely absorbed in 10 cases out of 143. In these 143 cases, also, the acetabulum was found more or less diseased in 119. In 10 cases an opening in the floor of the acetabulum communicated with the interior of the pelvis. In 4 cases perforation had taken place, and abscess within the pelvis. In 3 cases the acetabulum was trephined for the evacuation of pelvic abscess. Reparation may ensue in the diseased acetabulum,

when the head of the femur is removed from contact and attrition; as attested by the results of cases of dislocation consequent on disease, which in so advanced a condition must have involved the acetabulum. Or, the disease may progress to perforation, followed by pelvic abscess, and a fatal termination. The fair inference is, that excision will be rendered more safe by removing any diseased portion, or even the whole floor, of the cavity. Thus, the acetabular, and even the *pelvic* portions of bone removed, with success, have varied considerably in size. In 1 case Sir W. Fergusson removed nearly the whole of the acetabular cavity. In another case, Mr. Hancock removed the whole of the floor of the acetabulum, and the head of the femur. The patient recovered. In 1 case, Sayer, of New York, removed the acetabular cavity, with the spine and anterior crest of the ilium, as well as the head of the femur. The patient recovered. In another case, Mr. Bowman gouged the acetabulum, and the horizontal ramus of the pubes. The patient recovered. Lastly, Mr. Erichsen removed not only the whole floor of the acetabulum, but also the rami of the pubis and ischium, with part of the tuberosity of the ischium, and a portion of the dorsum ilii. The patient recovered. In my own cases, I have never had occasion to remove more than small portions of the acetabulum, which were scooped out in each case; the adjoining portion of the horizontal ramus of the pubes was denuded in one case, but it was left untouched and underwent repair. As a rule, I find, that superficial caries of any adjoining portion of pelvic bone is best left alone; rather than by groping about in the dark with a gouge, the vascular continuity of the integuments should be detached, and perhaps a portion of the carious surface may still be left unscraped. Nature, subsequently, completes the excision by molecular disintegration and discharge from the pelvic surface; with some prolongation only of the period of recovery, but with greater safety to the patient.

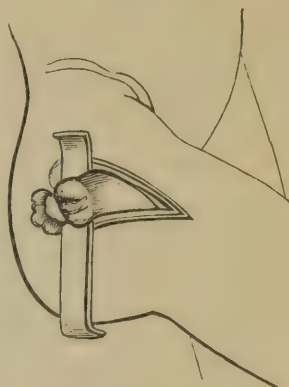
Lastly, *dislocation* is unfavourable, as implying an almost necessarily advanced stage of the disease constitutionally. Of 123 cases, more or less advanced to exhaustion, in 44 only, the head of the femur yet remained in the acetabulum.

*Operation.*—Excision of the hip-joint was originally proposed by White, of Manchester, in 1769, but the operation was first performed by Schmalz, of Pirnie, Saxony, in 1816; and first performed in this country, and for the second time in Europe, by Anthony White of the Westminster Hospital, in 1821; it was repeated by Hewson of Dublin, 1823; after which period the operation fell into disuse, until its revival by Sir William Fergusson, in 1845. Since that period it has been performed by many Surgeons, and in a large number of cases.

The hip-joint deeply placed, owing to the neck of the femur, is reached most conveniently by a T shaped incision; the vertical line, perhaps slightly curved, being made from just above the great trochanter downwards on the shaft to about three inches or less in extent (see Fig. 253), and the transverse line about half that extent on the summit of the longitudinal incision. The very limited extent of this latter incision avoids the femoral vessels anteriorly, and the crural nerve posteriorly. In disease of the joint, with perhaps consequent dislocation backwards on the dorsum ilii, and wasting as the result of long-standing disease, these incisions seem to be almost invited, so prominently does the trochanteric portion of the femur abut under the integument. By detaching the integument on either side of the vertical incision, keeping the knife turned towards the

femur especially on its inner side, the subjacent portion of femoral shaft is exposed; then, sinking the knife vertically in the transverse incision, just above the trochanter, the attachment of muscles thereto is divided; so that the finger can be readily passed down to the joint and its state ascertained. The capsular ligament will generally have given way or entirely disappeared. To turn out the remnant head of the femur for excision, it may be necessary to adduct and evert the limb, when with a touch of the knife on the bone, the round ligament yields and the head starts from its socket. Or, this ligament also may have disappeared, and the head and neck of the femur be so reduced, and the acetabulum so patulous, from more advanced disease, that the bone can be readily dislodged and hooked out with the finger. In a third class of cases, dislocation backwards has taken place. In any case, however, adduction of the limb across the opposite thigh presents the bone for application of the saw; and then the diseased portion is removed by one or more successive slices, the integument on either side being protected by a curved spatula. (Fig. 254.) The chain-saw may be used by those who prefer it. A gouge may be used to finish off the femoral excision; instead of unnecessarily removing any healthy portion of the trochanter, if that be left, or of the adjoining shaft. The acetabulum should be scraped rather than gouged, to remove any carious or denuded portion; or, more extensive pelvic excision may be necessary, and has proved successful. But superficial caries, acetabular or pelvic, will often recover itself, the former having been maintained by constant attrition of the femoral head. Any hæmorrhage is easily arrested by torsion. I have never had occasion to apply a single ligature in any hip-joint excision.

FIG. 254.



The limb can now be brought down straight, and a long interrupted-splint applied. Or, at first, the limb may be placed in an easy position on a pillow, and in the course of a few days, a long splint applied during the formation of flexible union. Or, guided by the pathological fact that this kind of union is required for the successful result of hip-joint excision, I have not used a splint from first to last, in any of my own cases. The healthy section end of the femur becomes drawn up, if dislocation has not already taken place, and the bone hitches on a healthy surface just out of the remnant acetabulum, where a sound fibrous ankylosis or false-joint is formed.

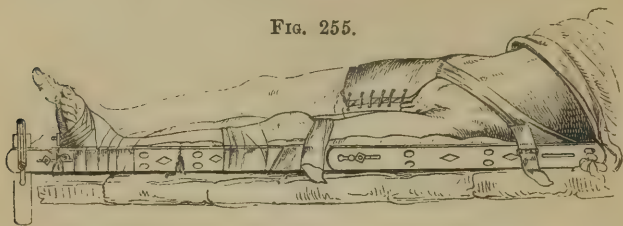
*Excision of the trochanter major* may occasionally prove sufficient; caries of this portion of the femur existing, without disease of the hip-joint. I have had one such case, and with a successful result.

The *after-treatment* of excision, whether of the hip-joint, or of the great trochanter alone, is very simple. The limb may be laid straight in bed, and retained in position only by a small side pillow, or roller sand-bag; without absolutely fixing the thigh. Or a long splint may be applied, extension being made from the opposite thigh, as recommended by Sir W. Fergusson. (Fig. 255.) Of these two modes of after-treat-



ment I prefer the former, especially for the joint-operation. The section-end of the femur is drawn up by muscular action, and hitches just above the acetabulum, which having been, generally, more or less superficially carious, is thus left to recover itself, undisturbed by any attrition of the femoral end of bone; while a new, and firmly fibrous, moveable joint forms, where the end of bone rests above the acetabulum. There is

FIG. 255.



little, or no, tendency to displacement after hip-joint excision, and the slight extra shortening which results from thus leaving the limb to itself, is unimportant compared with the advantages in regard to the acetabulum, and the formation of the best kind of new-joint requisite for the functional use of the limb, in progression, as well as for support. All my cases were treated in this way, and with perfect success.

*Results.*—(1) In relation to life or mortality. In 111 cases, collected by Dr. Hodges, of *unrecorded conditions* of operation; 56 recovered, 53 died from the combined effects of the operation and the previous disease; and in the remaining 2 cases, amputation was resorted to. Thus about 1 in 2 died,—a very high mortality. But Mr. Hancock presents the following very interesting results as to the mortality with reference to certain *guiding conditions* of disease for operation:—The *acetabulum* in a healthy state, gave a mortality of 6 in 18 cases, or 33 per cent. On the other hand, *acetabular disease* has had more favourable results of operation. Of the 10 cases in which perforation had taken place, 6, or 60 per cent., recovered; 2 only, or 20 per cent., died. Of the 4, in which not only perforation existed, but abscess also within the pelvis; 2 recovered, 2 died,—50 per cent. either way. Of the 3 in which the acetabulum was trephined for the evacuation of matter from the pelvis; 2, or 66 per cent., recovered; 1, or 33 per cent., died. Therefore, in the whole 20 of these apparently most unfavourable cases for excision, the mortality was only 5, 1 in 4, or 25 per cent. The relation of *pelvic disease* to mortality after operation, has already been noticed. *Dislocation* of the head of the femur having taken place; the percentage of recoveries was actually 46, against 23 where it had remained in its socket; the total number of cases compared being 143. Of my own 8 cases of hip-joint excision; in 4 there was dislocation, and they all recovered equally with the four in which dislocation had not occurred.

Another equally large series of cases—112, British and Foreign, has been collected by Dr. R. R. Good, late Surgeon in the Confederate American Army. This series is the more complete, as it embraces the most *essential particulars* respecting Excision of the hip-joint for disease, both in regard to its Mortality, and the state of the limb. We are thus enabled to take a commanding view of the whole subject; and in order

to observe the results, and their relationship more clearly, I have tabulated them.

*Tabular view* of 112 cases of Hip-joint-Excision, British and Foreign; Period 1860–8.

## MORTALITY.

*Collection of Cases by Dr. R. R. Good.*

- (1) Number of cases, 112.
- (2) Recoveries, 52, or 46·43 per cent.  
Deaths, 60, or 53·57 „  
Causes.—Exhaustion, 22. Phthisis, and progress of the disease, 10. Pyæmia, 5. Caries of the pelvis and purulent discharge, 4. Diarrhœa, 3. Exhaustion, with rapid pulmonary congestion, 2. Tubercular meningitis, tetanus, diphtheria, Amyloid degeneration of the organs, diffuse phlebitis of the limb, osteo-mylitis, hæmorrhage, acute necrosis of the femur, nervous collapse and pneumonia, each 1.
- (3) Disease, recorded in 29 cases.  
Scrofula, 3; 2 deaths, or 66·67. Cold, 4; 1 death, or 25·00.  
Injury, 20; 4 deaths, or 20·00. (2 cases not included.)
- (4) Duration previous to operation, recorded in 58 cases.  
Average duration, 2 years 3 months. In *acute* cases, or before 7 months; of 9 cases, 7 deaths or 77·77. In *chronic* cases, or 2 years and more; of 30 cases, 10 deaths, or 33·33; a balance in favour of chronic disease, 44·45.
- (5) Age, in the 52 recoveries; average, 11 years; extremes, were 2 „ years and 58 years.  
„ in the 60 deaths; average, 14 years; extremes, were 3 „ years and 40 years.  
„ from 2 to 12 years, 59 cases; 24 deaths, or 40·67.  
„ 12 to 20 years, 25 cases; 15 deaths, or 60·00.  
„ 20 to 58 years, 17 cases; 13 deaths, or 76·47.
- (6) Sex. 79 males.  
30 females.  
(3 sex unrecorded.)
- (7) Bone excised, recorded in 105 cases.
  - a Femur; section above great trochanter in 49 cases, 30 deaths, or 61·23. Section below great trochanter in 56 cases, 27 deaths, or 48·21. A balance in favour of section below,—13·01
  - b Acetabulum—*Diseased* in 72 cases, or 64·28. Deaths, 39, or 54·16.  
Abscess of pelvis, recorded in 6 cases; 2 deaths.  
Perforation in 11 cases (of the 72); 6 deaths, or 54·55.  
Perforated surgically in 5 cases (of the 72); 1 death, or 80·00.  
Gouged in 33 cases; 15 deaths, or 45·45.  
No interference in 6 cases; 5 deaths, or 83·33.  
—*Healthy* in 14 cases. Deaths 7, or 50·00. As compared with the mortality of diseased condition, 54·16; a balance of only 4·16 in favour of healthy condition.
- Dislocation, recorded in 17 cases; 6 deaths, or 35·29.  
As compared with *non*-dislocation in 93 cases; 52 deaths, or 55·92. A balance of 20·63 in favour of Dislocation.

<i>Countries.</i>		<i>Cases.</i>			<i>Deaths.</i>
Germany	...	34	...	...	22, or 64·71
England	...	32	...	...	11, or 34·37
America	...	29	...	...	13, or 44·83
France	...	14	...	...	12, or 85·71
Russia	...	3	...	...	2.

---

112

*Author's Collection.*

(1) Charing Cross Hospital; period, 1862-70. (Per Mr. Hancock.) Number of cases, 15; recoveries, 13; deaths, 2.

(2) Royal Free Hospital; period, 1863-70. Number of cases, 11; recoveries, 10; deaths, 1.

(3) King's College Hospital; period, last five years. (Per House-Surgeon.) Number of cases, 10; recoveries, 9; deaths, 1, six months after operation from tubercular meningitis.

(4) London Hospital; period, last five years. (Per Mr. J. McCarthy.) Number of cases, 10; recoveries, 4; deaths, 5; 1 progressing favourably.

(5) St. Thomas's Hospital; period, 1866-70. (Per Mr. F. Churchill.) Number of cases, 8; recoveries, 1; deaths, 5; 2 under treatment.

(6) Westminster Hospital; period, last five years. (Per Mr. F. Mason.) Number of cases, 6; recoveries, 6.

(7) Guy's Hospital; period, 1864-69. (Per Mr. T. Bryant, from Dr. Steel, Superintendent.) Number of cases, 6; recoveries, 5; deaths, 1.

(8) Liverpool Royal Infirmary; period, last five years. (Per Mr. W. J. Cleaver.) Number of cases, 4; recoveries, 3; deaths, 1.

(9) Great Northern Hospital; period, last five years. (Per Mr. J. Willis.) Number of cases, 3; recoveries, 3.

(10) Chalmers Hospital, Edinburgh; period, last six years. (Per Mr. P. H. Watson.) Number of cases, 3; recoveries, 1; deaths, 2.

(11) St. Mary's Hospital; period, last five years. (Per Mr. Gascoyen.) Number of cases, 2; recoveries, 2.

(12) Royal Albert Hospital, Devonport; period, last five years. (Per Mr. W. P. Swain.) Number of cases, 2; deaths, 2.

(13) Royal Sea Bathing Infirmary, Margate; period, last five years. (Per Mr. J. R. Clouting.) Number of cases, 1; deaths, 1.

(14) Royal Infirmary, Edinburgh; period, 1865-69. (Per Mr. P. H. Watson.) Number of cases, 1; deaths, 1.

(15) St. Bartholomew's Hospital; period, 1866-70. (Per Mr. Callender.) No cases.

Taking the results of the preceding collections of cases, three *general* conclusions may be established respecting the rate of mortality from Hip-joint excision, for disease:—(1) In different countries, a very different mortality, being highest in France, and lowest in England. (2) An average death-rate, of 1 in 4 or 5 (about the same as that of knee-joint excision, for disease). (3) Very different death-rates in the hands of individual Surgeons, British and Foreign—varying from, no mortality, to 1 in 2 or 3, 1 in 5, 2 in 3, 4 in 5, or even total mortality; thus differing far more extremely than the mortality of knee-joint excision for disease. It can scarcely be doubted that the conditions of disease, both local and constitutional, in the cases selected for excision, have mainly determined this different resulting mortality; although, the mode of performing the operation, and the after-treatment, have also been influential.



*Mortality compared with hip-joint Amputation.*—In 42 cases of amputation at the hip-joint for chronic disease; 24 recovered, and 18 died,—a mortality nearly as high as 1 in 2. It will be observed that the total number of cases here referred to is small, in proportion to the number of hip-joint excisions for disease. But the whole number of hip-joint amputations, hitherto published, is only about 126,—including the cases of injury and disease.

(2) *State of the Limb.*—In Dr. Hodges' collection of 111 cases, the 56 recovered "with more or less useful limbs." In Dr. Good's collection of 112 cases, of the 52 recoveries, 42 patients could use the limb, and in the remaining 10 cases, this result was not noted. The 42 cases are divided as follow:—

19	could walk without support.
9	„ with the help of a stick.
1	„ „ two sticks.
1	„ „ a splint
1	„ „ a crutch.
2	„ „ two crutches.
9	the manner of walking is not specified.

In 40 of the 52 recoveries, it was specially noted that the limb supported the weight of the body. In one case, crutches were necessary for this purpose, and in the remaining 11 cases, this particular was not noted. The movements in the new joint were reproduced in 28 cases, and in only 1 immovable ankylosis was the result. The ultimate period when the patients were seen after operation, varied from three months to five years. Their cure was ascertained, in most cases, after two or three years. Of the 52 cured, the average period of known permanent result, was nineteen months and four days. In my own 8 cases, the shortest period of known permanent cure was two and a half years; and the longest ascertained result, five years.

The *average duration of the period of recovery* has not generally been noted in the records of cases. In Dr. Hodges' collection of forty-nine cases wherein this particular was observed, the average was 230 days. In my own cases, the average period of *union* was three months.

In extreme cases of hip-joint excision—extreme as to the extent of bone removed—the resulting state of the limb may yet be successful. It was so in my own two such cases, after removal of the upper end of the femur, to four inches and four and a half in length, with one inch more of cancellated bone, and entering the medullary canal, in both cases; and, also in both the cases of acetabular and pelvic bone-disease, after removal of the affected portions of bone by Mr. Hancock and Mr. Erichsen respectively,—the patients recovering, and with useful limbs.

SECTION, rather than Excision, of the upper end of the femur, is a procedure which has been devised, and practised in a few instances, for failure of the natural cure,—osseous, instead of ligamentous, ankylosis of the joint, with useless mal-position of the limb, as by flexure on the thigh and abduction. This condition, calling for operative interference, is comparatively rare.

*Section of the femur* has been performed, either between the trochanters, or in the neck, about its middle, and with successful results. The one line of section was originally proposed and performed by Dr. Rhea Barton, of Philadelphia, in 1826. A crucial incision was made over

the great trochanter, seven inches in length and five inches in the horizontal direction; a fine saw was introduced, the femur divided transversely between the trochanters, and the limb brought down. The result was successful; an artificial moveable joint formed: but seven years afterwards, ankylosis ensued, and two years subsequently, the man died of phthisis, nine years after the operation. A similar operation in situation—between the trochanters, but an *excision* of a transverse plate of bone, of an elliptical form upwards, by means of the chain-saw, was performed by Dr. Louis Sayre, of New York, in two cases, both in the year 1862. The object of this procedure was to form a false joint, of a ball-and-socket character. The first case was completely successful at the end of six months, the patient, aged twenty-six, being able to stand on either leg without crutch or cane; and upwards of five years afterwards the result was permanent: the man could move and walk with practical agility. In the second case, the operation was followed by abscess and necrosis; but the patient, a female aged twenty-four, died, apparently of tubercular pneumonia. Post-mortem examination showed that an artificial joint had formed; the articular surfaces were tipped with cartilage and provided with a synovial membrane, and there was a complete capsular ligament.

*Subcutaneous* section, and higher up, in the neck of the femur, was first proposed and practised, by Mr. William Adams, in December, 1869. The object of this procedure was to procure an artificial, moveable joint;

FIG. 256.



that result having failed, osseous ankylosis, but with the limb in a straight position, was sought to be established, and obtained. A long tenotomy-knife was entered a little above the great trochanter, and passed down to the neck, the capsular ligament was opened freely, and the neck of bone divided by a narrow, fine saw, applied from before backwards. (Fig. 256.) The tendons of the long head of the rectus, the adductor longus, and tensor vaginæ femoris muscles, were then divided; the limb was brought down straight, and fixed by a long interrupted Liston's splint. Five months after this operation, and subsequent treatment, the man, aged twenty-four, was exhibited at the Medical Society of London, where he walked about the room without any assistance—a successful result which has since become permanently secured. The annexed figures represent

the appearances of the limb, before and after operation; in the latter, the patient standing on the limb, to show the restored usefulness of the member. (Figs. 257, 258.)

This operative procedure has since been practised successfully in three other cases—by Mr. T. R. Jessop, of Leeds; Mr. F. W. Jowers, of Brighton; and Mr. Furneaux Jordan, of Birmingham. The fact of four consecutively-successful cases having occurred, goes so far to establish subcutaneous section of the neck of the femur as a surgical procedure for osseous ankylosis of the hip-joint with mal-position of the limb.

I may now give a summary of my own series of hip-joint cases; as

affording *typical* illustrations of the conditions of disease which are appropriate for excision, and the results, proximate and permanent, in each case; an analysis being appended, with reference to the several *questions* of importance pertaining to excision of the hip-joint for disease.

FIG. 257.



FIG. 258.



I have drawn up these cases from clinical notes carefully taken—in the first two by Mr. John B. Foster, in the second two, by Mr. Marriott, formerly House Surgeons; and in the remaining four, by Mr. T. C. Murphy, Senior House Surgeon, at the Royal Free Hospital.

**TYPICAL CASES OF HIP-JOINT EXCISION.—CASE 1.**—William M—, æt. 26. Admitted into the Royal Free Hospital, March 28th, 1864. *Scrofulous caries* of the left femur; the head and the articular cartilage entirely destroyed, the neck, great trochanter, and one inch of shaft involved, with one inch more of cancellated structure; similar disease of acetabulum, and horizontal ramus of pubes; *dislocation* on dorsum ilii with abscess; constitutional condition, *advanced hectic*; disease of traumatic origin; duration of disease, four years; treatment, three years. *Excision* of four inches of femur, and one inch of cancellated structure. *Recovery*, with a freely moveable joint and a useful limb, in three months. *Permanent* result known after two years and a half.

**CASE 2.**—John R—, æt. 16. Admitted into the Hospital, July 22nd, 1863. *Caries* of left femur; its neck and great trochanter, the head involved, with circumferential destruction of the articular cartilage, and disease in the shaft to two inches in extent, with one inch more of cancellated structure; similar disease of acetabulum; *dislocation* on dorsum ilii with abscess; constitutional condition, *advanced hectic*; immediate cause, cold; duration of disease, one year. *Excision* of four



inches and a half of femur, and the one inch of cancellated structure. *Recovery*, with a freely moveable joint, and a useful limb, in two months and a half. *Result* known to be *permanent* after five years.

CASE 3.—George C——, æt. 15. Admitted into the Hospital, June 9th, 1864. *Caries* of right femur; its head and neck entirely destroyed; great trochanter and a small piece of the shaft involved; similar disease of acetabulum; *dislocation* and abscess on dorsum ilii; *health good*; disease of traumatic origin; duration of disease, two years. *Excision* of one inch and three-quarters of femur. *Recovery*, with a freely moveable joint and a useful limb, in three months.

CASE 4.—Edward M——, æt. 8. Admitted into the Hospital, June 10th, 1864. *Caries* of left femur, its head and neck destroyed; similar disease of acetabulum; advanced hectic; immediate cause, cold; duration of disease, five years. *Excision* of two inches of femur. *Recovery*, with a moveable joint and useful limb, in two months.

CASE 5.—Jane L——, æt. 5. Admitted into the Hospital, March 4th, 1867. *Caries* of right femur, its head and neck destroyed; similar disease of acetabulum; *health good*; of traumatic origin; three years' duration, two and a half years' treatment. *Excision* below great trochanter. *Recovery*, with a moveable joint and useful limb, in four months. *Result* known to be *permanent* after three years.

CASE 6.—Catherine R——, æt. 5. Admitted into the Hospital, October 31st, 1866. *Scrofulous caries* of left femur, its head and neck destroyed; similar disease of acetabulum; *dislocation* and abscess on dorsum ilii; advanced hectic; disease apparently of traumatic origin; one year and eight months' duration, and treatment. *Excision* below great trochanter. *Recovery*, with a moveable joint and useful limb, in three months.

For the particulars of this case I am indebted to my colleague, Mr. John D. Hill, then Senior House Surgeon in the Hospital.

In two other cases, the essential particulars were similar to one or other of the above series.

ANALYSIS OF THE CASES.—The following facts respecting the foregoing cases of hip-joint disease and excision seem specially worthy of notice.

(1) *Conditions of Disease*.—*Caries* in all cases, with destruction of the femoral articular cartilage, entirely in 1, 3, 4, 5, 6, or in five cases; circumferentially only in Case 2. Extent of bone diseased was the head and neck in each case; with the great trochanter and portion of the shaft in Cases 1, 2, 3; and an extra portion of cancellated structure of the shaft in Cases 1 and 2; *caries* of the acetabulum to some extent in all cases, and of ramus of pubes in Case 1; *dislocation* on dorsum ilii in Cases 1, 2, 3, 6; or in four out of the six cases.

(2) *Immediate Cause*.—Injury in Cases 1, 3, 5, 6; cold in 2, 4.

(3) *Constitutional Condition*.—Advanced hectic in Cases 1, 2, 4, 6, or in four of the six cases; *health good* in Cases 3 and 5.

(4) *Previous Duration of Disease*.—Four years, one year, two years, five years, three years, one year and eight months. *Previous duration of treatment*.—Case 1, three years; Case 5, two and a half years; Case 6, one year and eight months.

(5) *Age and Sex*.—Age: 26, 16, 5, 8, 5, 5 years. Sex: four males and two females.

(6) *Operation*.—*Incision* T-shaped in all cases. *Portions of bone excised*: (1) Four inches of femur, and one inch of cancellated structure scooped out; (2) Four inches and a half of femur, and one inch of cancellated structure scooped out. In both these cases the medullary canal

was entered; (3) One inch and three-quarters of femur; (4) Two inches of femur; (5) Section just below great trochanter; (6) Section just below great trochanter. Small portions of the acetabulum were scooped out in each case. *Hæmorrhage* inconsiderable in all the cases. No ligatures required. Silk sutures and water-dressing applied in all the cases. No *splint* was used in any of the cases, the section of the femur being left free to form a fibrous ankylosis.

(7) Primary union ensued in all the cases, except the first, wherein the wound healed by granulation.

(8) *Results*.—Firm fibrous ankylosis, with a moveable joint and useful limb in all the cases. Period of union, average three months.

(9) Result known to be *permanent* in Case 1, after two and a half years; in Case 2, after five years; in Case 5, after three years.

ANKLE-JOINT.—The operation of excision with regard to the ankle-joint has been confusedly described in Surgical works as signifying the removal of any portion of the foot, whether pertaining to the ankle-joint or not; in the operations originated by Liston, Wakley, and Teale. But, by excision of the ankle-joint, I mean the removal of the articular surfaces of the bones which enter into the formation of this joint—namely, the lower articular ends of the tibia and fibula, and the upper portion of the astragalus.

This operation, first performed for *injury* by Hippocrates, and revived by Hey, of Leeds, in 1766, was first performed for *disease* by Moreau, senior, in 1792; then by Moreau, junior, in 1796; next by Mulder, in 1810; and probably by Champion, in 1813. But the credit of introducing the operation into British Surgery is due to Mr. Hancock, who excised the ankle-joint for disease in February, 1851. The operation has since been resorted to by Professor Humphry, of Cambridge, in four cases, and by other Surgeons, including myself.

*The Conditions of Ankle-joint Disease Appropriate for Excision*.—Disease of the ankle-joint, according to Mr. Hancock, frequently commences in the synovial membrane, and extends to the articular surfaces; thus, secondarily, involving the bones. But it may also commence, as scrofulous disease, in the cancellous tissue of the long bones—tibia and fibula, or of the astragalus, or of all three bones. In the former condition, the affected portion of the articular surfaces may be removed with safety and advantage. In the latter condition, excision is not inappropriate.

Other and different opinions are held by some Surgeons of repute, as by Mr. Furneaux Jordan, of Birmingham, both with regard to the origin of disease of the ankle-joint, and the propriety of excision. That disease rarely extends from the synovial membrane, but begins in the cancellous tissue, either of the extremities of the tibia and fibula, or in that of the astragalus; and, it is said, necessarily affects the whole of that bone. In the one condition, excision of the extremities of the long bones, as the local source of the disease, is said to be inadmissible; while, in the other condition, the whole bone—astragalus, must be excised. The former contra-indication is plainly at variance with the established practice of excision in disease of the knee-joint, under strictly analogous circumstances—when the end of the femur, or head of the tibia, is the seat of disease. Excision of the extremity of either of these long bones is not inadmissible, but only, perhaps, less favourable in scrofulous disease of the cancellous tissue.

The fair inferences from this diversity of opinion respecting the

diseased conditions of the ankle-joint for which excision is appropriate, would appear to be:—

(1) When disease commencing in the synovial membrane, has extended to and destroyed the articular surfaces of the tibia and fibula, that of the astragalus, or of both opposed surfaces.

(2) When disease, having the same articular consequences, commenced in the cancellated tissue, either of the long bones, or of the astragalus, provided it be limited to part of this bone, its upper articular portion.

(3) Whether the disease originated in the synovial membrane or in the articular cancellated tissue, resulting in destruction of the cartilages, without ankylosis; excision should be resorted to *before* the supervention of constitutional exhaustion.

*Operation.*—Hancock's description of excision of the Ankle-joint, as first performed by him in England (1851), is as follows:—"I commenced an incision behind, and about two inches above, the external malleolus, carrying it forwards beneath that process across the front of the joint, and terminating about two inches above and behind the inner malleolus. This incision included the skin, without implicating the tendons or their sheaths. The flap thus formed was dissected up, and the peronei tendons were detached from the groove behind the fibula and cut through, as were the external lateral ligaments close to the fibula, with a pair of bone-nippers. I next divided the fibula about an inch and a half above its inferior extremity, and cutting through the inferior tibio-fibular ligaments, detached the external malleolus. Turning the leg on to its outer side, I cut through the internal lateral ligament, carefully keeping the knife close to the end of the tibia, to avoid the posterior tibial artery. The tendons of the tibialis posticus and flexor communis were then detached from the groove behind the internal malleolus, and taking the foot in both hands, Mr. Avery holding the leg, I dislocated the foot outwards, thus bringing the end of the tibia with the internal malleolus prominently through the wound. These were removed by a common amputating saw, applied half an inch above the horizontal articulating surface of the tibia, the soft parts being protected by a spatula; the upper articulating surface of the astragalus was also removed by a metacarpal saw, held horizontally. The foot was then restored to its proper position, the cut surface of the astragalus being adapted to the cut surface of the tibia; and the wound having been closed by sutures, except on the outer side, left open for the free escape of discharge, the leg was placed on an external splint, having an opening corresponding to the wound."

The parts divided by this operation were—the skin, peronei tendons, internal and external, lateral and inferior tibio-fibular ligaments, and the articular surfaces of the bones. In subsequent operations, the tendons were preserved entire. In no instance have the tibial arteries, anterior or posterior, been wounded, and never has it been necessary to apply a single ligature.

*Lateral* incisions alone, without the anterior communication, have since sufficed. This was my mode of operation in two cases.

The *After-treatment* of ankle-joint excision should be conducted in accordance with the principles laid down respecting the excision of other joints; regard being had to the kind of ankylosis necessary for the use of the limb. The fixed position of the foot must be maintained during the period requisite to secure a firm ankylosis of the osseous surfaces made by excision—the lower ends of the tibia and fibula, and the upper sur-



face of the astragalus ; thus to adapt the foot for support and progression. The wounds, one on either side of the ankle, are dressed from day to day ; but the splint should be removed and reapplied *very seldom*. In my own excisions of the ankle-joint, I have fixed the leg on a flat back-splint, provided with a foot-piece ; thus secured, displacement can scarcely occur, and the side wounds are freely accessible for cleansing and dressing. Eventually, a starched bandage may be applied ; and the foot being slung from the neck, the patient gets about on crutches, as the foot is gradually brought into use.

*Results.*—Excision of the Ankle-joint, for disease, presents some most interesting results, both in relation to the mortality of this operation, and the state of the foot, with the probability of secondary amputation ; both these aspects of the operation being considered also as compared with amputation of the leg, and with Syme's and Pirogoff's operations of amputation at the Ankle-joint, severally for disease.

For certain valuable statistics bearing on these important questions, I am indebted to Mr. Hancock, who liberally placed at my disposal the manuscript of his Lectures at the Royal College of Surgeons.

(1) In relation to Mortality.—The results of 32 cases of excision of the ankle-joint for *disease* have been collected by Mr. Hancock ; all that he could find recorded in the practice of British Surgeons. Of these 32 cases, 7 died—about 1 in 5, or a fraction above 21 per cent. But of the 7 deaths, 4 are reported to have died of consumption, 1 suffering from that disease at the time of operation ; while another died of secondary syphilis. This reduces the average mortality to 1 in 16, or about 6 per cent. Of my own two cases, both lived.

#### *Author's Collection.*

(1) Charing Cross Hospital ; period, 1858-65. (Per Mr. Hancock.) Number of cases, 6 ; recoveries, 6 ; amputation after excision, 1 ; recoveries, 1.

(2) Royal Free Hospital ; period, last five years. Number of cases, 4 ; recoveries, 4 ; amputations after excision—Syme's amputation, 1 ; recoveries, 1.

(3) Chalmers Hospital, Edinburgh ; period, last six years. (Per Mr. P. H. Watson.) Number of cases, 4 ; recoveries, 4.

(4) Royal Infirmary, Edinburgh ; period, 1865-69. (Per Mr. P. H. Watson.) Number of cases, 3 ; recoveries, 2 ; deaths, 1.

(5) St. Bartholomew's Hospital ; period, 1866-70. (Per Mr. Calender.) Number of cases, 1 ; recoveries, 1.

(6) St. Thomas's Hospital ; period, 1866-70. (Per Mr. F. Churchill.) Number of cases, 1 ; deaths, 1.

(7) London Hospital ; period, last five years. (Per Mr. J. McCarthy.) Number of cases, 1 ; recoveries, 1 ; amputations after excision, 1 ; recoveries, 1.

Guy's, King's College, Westminster, St. Mary's, and Great Northern Hospitals, Liverpool Royal Infirmary, Royal Albert Hospital, Devonport, and Royal Sea-Bathing Infirmary, Margate ; period, each last five years. No cases.

*Compared with the Mortality of Amputation.*—(a) in the leg ; (b) at the ankle-joint—Syme's and Pirogoff's amputations of the foot.

(a) *Amputation of the leg*, for disease, in Civil Surgery, has a mortality of 26 per cent. ; whereas, in the results of ankle-joint excision for disease,

the mortality, already quoted, has been only 6 per cent. ; 20 per cent. difference in favour of excision

(b) *Amputation at Ankle-joint—Syme's Amputation.*—Of the *whole* number of Ankle-joint amputations—219, as collected by Mr. Hancock, in 144 amputation was performed for disease—caries. Of these, 10 only were fatal, or somewhat less than 1 in 14; and as 3 died of phthisis, 1 of diarrhœa, and 1 a year after operation, 5 deaths only remain; or a reduced mortality of 1 in 28. *Pirogoff's Amputation.*—Fifty-eight cases of this amputation represent the *whole* number, performed by British Surgeons, of which Mr. Hancock has been able to gather the particulars. Nearly 100 cases reported by Pirogoff as having been performed in Russia, are not available for statistical comparison. Of the 58 cases, 5 were fatal, or about 9 $\frac{1}{2}$  per cent. Of the remaining 53 recoveries, in 29 the operation had been resorted to for caries.

(2) *State of the Foot.*—Of the 32 cases operated on by excision of the ankle-joint, 21 recovered with good useful limbs.

*Secondary amputation, after Ankle-joint excision.*—Of the 32 cases, 2 only underwent secondary amputation, and both recovered.

*Compared with Secondary amputations, after amputations of Foot.*—(a) After Syme's operation; of the 144 cases submitted for caries, 9 underwent secondary amputation; but of these, 1 was a confirmed drunkard, 1 had been primarily operated on for traumatic gangrene, 1 two years previously for an accident, and in the remaining 2, the disease is not stated. (b) After Pirogoff's operation, of the *whole* 58 (for disease and injury) 5 only suffered secondary amputation, but in 4 of these the primary operation had been performed for caries.

Comparing these two *amputations* of the foot, Mr. Hancock observes; as regards the occurrence of suppuration, the percentage of deaths, of recoveries and periods of recovery, and secondary amputations; the evidence of British Surgery is in favour of Syme's operation, whilst as regards sloughing of the flap, it is decidedly in favour of Pirogoff's proceeding. Syme's amputation appears to be unquestionably the best for *disease*, and Pirogoff's for the accidents of civil life, since by it we preserve an increased length of limb.

**TARSAL BONES.**—Excision of the Tarsal Bones comprises certain recognised operative procedures, which correspond to the lines of the osseous articulations; as removal of the astragalus, or of the os calcis. But the plan and performance of excisional operations on the foot should not be restricted by these anatomical limitations. The modification of these operations on the foot, according to the kind and extent of the disease, well illustrates the guiding principle of excisional surgery; and this application of the general principle I have laid down, is specially advocated by Mr. Hancock, in the Lectures already referred to.

The *conditions of disease* for which excisional operations on the foot may become appropriate, are similar to those which affect other bones and their articulations; namely, the destructive results of inflammation, and especially in the form of caries. According to the extent of such disease, partial or complete excision of any one, or more, tarsal bones may be necessary. I proceed to describe the various operations, and to estimate their value by their results.

(1) *Excision of Astragalus.*—*Partial* excision of the astragalus, for disease, was first attempted by Severin in 1646, and in England by Ramsay in 1792. Since that time it has been performed by other Surgeons, but in a comparatively few authentic cases.

*Complete Excision.*—This operation, as for disease, was first performed by Mr. Busk in 1850. Three other cases only have since been recorded in England; one each by Mr. Erichsen, Mr. Holmes, and the late Mr. Statham—An incision along the outer and anterior aspect of the ankle, will expose the bone; its neck should then be severed with strong cutting pliers; and, some space having been thus made, the bone may be drawn out of its bed by the lion-forceps, the knife being used to detach its ligamentous connexions, but applied cautiously towards the inner side of the joint in proximity to the plantar arteries. It may be necessary to extirpate the bone piecemeal, when its substance breaks down in a carious state; it must then be gouged out.

Some of the *anterior tarsal bones* may have to be removed *with* the astragalus. *Liston's Operation* on the foot—as the excision thus extended, in a noted case, might be named—consisted in the removal of the astragalus, scaphoid and two cuneiform bones. The case is reported in the *Edinburgh Medical and Surgical Journal* of January, 1821.

*Results.*—Of *partial excision* of the astragalus, in 27 cases recorded; 8 were operations for disease—caries; 5 terminated well, 1 ended in ankylosis, and in 2 the result was not stated. *Complete Excision.*—In 109 cases of complete excision of the astragalus, 14 were operations for disease; 13 being for caries, and 1 for necrosis. Of the 13 cases; 1 died, 8 recovered with good and useful limbs, 2 underwent secondary amputation two years after excision, and both recovered; in 2 the results were doubtful. The case of excision for necrosis did well.

(2) *Excision of Os Calcis.*—*Partial excision* seems to have been first performed for injury, in the removal of a musket-ball from the os calcis, by Formius, as long since as the year 1669.

*Complete excision* was first performed, and for disease—necrosis, by M. Robert of Prague in 1837. The second operation, and the first in this country, was by Mr. Hancock in May, 1848. The first successful case in England was by Mr. Greenhow of Newcastle, in the same year—1848; and two equally successful cases of complete excision, in the hands of that Surgeon, followed also in that year. Since then, the operation has been practised, with varying success, by other Surgeons; principally, by Sir William Fergusson, Teale of Leeds, Humphry of Cambridge, Cann of Hereford, Pemberton of Birmingham, Potter of Newcastle, Mr. Holmes, Mr. Erichsen, and myself.

The operation is thus performed:—The patient lying on his face—with the sole of the foot uppermost; an incision, with a stout bistoury, may be commenced at the calcaneo-cuboid articulation, just above the sole of the foot, and carried backwards round the heel, forwards, to an equal point on the inner side. This *sole flap* of integument is raised forwards from the under surface of the os calcis, and in its whole thickness down to the bone, so as to form a good cushion; a slight perpendicular incision is made, opposite the tendo-Achillis, into this horizontal incision, and with a little reflection of the integument to either side, the tendon is severed from its insertion. The knife is then entered posteriorly, over the upper surface of the os calcis, and the strong interosseous ligament connecting it with the astragalus is divided, somewhat as an oyster is opened; the bone can then be raised, and its lateral attachments being cleared by a gentle application of the knife, the calcaneo-cuboid articulation is opened, and the bone completely detached.

Or, an incision may be made, as for Syme's amputation at the ankle-joint, and a *heel-flap* having been formed, the os calcis is exposed; lateral



incisions are continued, on either side, along the sole of the foot to the line of the calcaneo-cuboid articulation, whereby a short *sole-flap* is reflected forwards; and the operation completed as before. The objection to this plan of excision is the liability to sloughing of the heel-flap, in disease of the os calcis; fistulous openings frequently having formed posteriorly, where the flap is attached. The advantage of a heel-flap is that the excision can be readily converted into Syme's amputation, in the event of the astragalus being found to be extensively involved. This method, therefore, was recommended by Mr. Teale, and practised by Mr. Page, as a precautionary proceeding in excision of the os calcis.

Apart from the contingency of sloughing, I prefer the sole-flap method of excision.

(3) *Ercision of the os calcis and astragalus—Wakley's Operation*—is performed much in the same manner as the second method of excision of the os calcis alone. The only differences are; an *additional* incision between the malleoli posteriorly, curving down to the insertion of the tendo-Achillis, so as to expose the astragalus, on raising this flap of integument; and, that the integument of the heel between this incision and the incision across the heel, from malleolus to malleolus, forming the heel-flap in the other operation, is here removed. The bones are excised through the gap thus made posteriorly, by dividing the tendon and lateral ligaments; lateral incisions being continued along the foot to the line of the calcaneo-cuboid and astragalo-scapoid articulations, so as to give access to these articulations. The malleoli are removed with bone-nippers. The posterior tibial artery must be ligatured, but the anterior tibial is avoided by very cautiously using the knife, in removing the astragalus in front of the tibia.

This excision would probably meet the difficulty of disease extending up to the ankle-joint, and, in such case, prove a substitute for Syme's amputation at the ankle-joint. The operation was performed by Mr. Wakley at the Royal Free Hospital, in December 1847, and the case is reported in *The Lancet* of July, 1848.

*Results.*—Of *partial* excision of os calcis, in 42 cases, collected by Mr. Hancock, 38 were operations for *disease*; 25 for caries, 12 for necrosis with sequestra, and 1 necrosis. Of the 25, 1 died the day after operation of diarrhœa, 14 recovered at periods varying from six weeks to six months; 2 required a second operation but recovered, and 1 underwent secondary amputation; while of the remaining 7 the result is not given. Of the 12 cases; 3 recovered, 1 required a second operation, 1 secondary amputation; and of 7 the result is not stated.

*Complete Excision.*—Of 18 cases—the particulars of which are authenticated—in 14 the disease was scrofulous; and in 11 of these, this condition was entirely constitutional, in 1 it is said to have originated from a nail having been run into the heel, and in 2 to have followed sprains. Of the 11 cases; 1 died of diphtheria, 7 recovered and with perfect use of the limb, while 3 suffered secondary amputation—2 from recurrence of disease in the remaining tarsal bones, and 1 owing to erysipelas. Of the 3 cases induced by injury; 2 recovered completely, and the result of the third was doubtful.

The *general* results of complete excision of the os calcis, are thus represented in 34 authenticated cases; 1 died of diphtheria, 25 recovered completely, 4 underwent secondary amputation; and of 4 the results are not given.

In one case of excision of the *os calcis*—for caries, I removed also the cuboid bone and a small portion of the external cuneiform bone, both of which were involved in the disease. The patient recovered, and with a thoroughly sound and permanently serviceable foot; this result having been established by two years' duration, when the weight of the body could still be supported by the foot, and the ankle-joint had free motion. He walked without the aid of a crutch or stick. The particulars of this most successful case are reported in *The Lancet* of July 23, 1864.

*Compared with sub-astragaloid amputation.*—This operation has been little practised in England, but chiefly in France. It appears to have been performed altogether in 22 cases, as collected by Mr. Hancock. The results of some are not stated. Of the whole number; 6 were operated on by Malgaigne, 1 by Maisonneuve, and 1 by Nélaton; in 9 collected by Vacquer, all terminated favourably, 1 by Dr. John Traile of Arbroath, was successful; in 2 by Mr. Simon, one was successful, the other patient died of tetanus at the end of a fortnight; in 1 by Garner of Stoke-upon-Trent, the report was unfavourable, and 1 by Mr. Hancock was successful.

The *Cuboid*, *Scaphoid*, and three *Cuneiform Bones*, may severally require Excision; and preferably to removal by Chopart's amputation—in the articular line between the *os calcis* and astragalus behind and the cuboid and scaphoid in front, whereby the two latter tarsal bones, and three cuneiform bones, with the whole of the metatarsus and toes, are sacrificed. But the conditions of disease appropriate for excision rather than amputation, are not determinable by any precise rules; and either operation must be selected according to the judgment of the Surgeon in each particular case.

For the operations of excision, no particular directions can be laid down; the lines of incision must be guided by the state of the integument, and the facility for gaining access to the bone and its articulations.

The *Metatarsal Bones* may also be subjected to excision, either at their articular ends, or of the whole bones. These operations of extirpation are more desirable than the sweeping amputation of the metatarsal portion of the foot, including the toes, by Hey's operation—in the line of the tarso-metatarsal articulations. The choice of operation must, here again, be determined in each particular case, by the kind and extent of disease.

The *Toes* are not eligible for excision; except at their articulations occasionally, or of the ungual phalangeal bones. Removal of the intermediate phalanges will scarcely leave a useful toe. With regard to the *great toe*; its metatarso-phalangeal articulation may occasionally be excised, or the last phalangeal bone removed; thus preserving the ball of the toe for the support of the arch of the foot.

But the *results* of these excisions of the metatarsal bones and phalanges of the toes, or of their articulations, are less successful than in the corresponding bones of the hand; the toes or their contracted portions remaining comparatively useless or inconvenient.

**ELBOW-JOINT.**—This joint appears to be, and certainly in my own experience has been, not unfrequently amenable to treatment without operative interference, in the destructive stage of inflammatory disease, by ulceration of the articular cartilages.

The *natural cure* by ankylosis supervenes more readily, apparently, than in other joints; and fibrous union usually occurring, a moveable joint and useful limb is the result.

The following case, which came under my care, is so good an example of this mode of cure, that its history seems worthy of notice. Mrs. P—, aged forty, states (1857), that in 1840, seventeen years ago, a heavy door slamming, struck her left elbow on the outer side. Some pain and swelling ensued, which gradually subsided. Pain, however, was felt occasionally after using the arm, during the next six years. Then the forearm gradually became bent on the arm, but the limb could be forcibly straightened. In 1855, she had rheumatic fever; the injured joint was first affected with acute pain and swelling, and other joints subsequently. The swelling of the elbow proceeded to abscess, which broke and discharged matter; leaving seven sinus openings, of which, two in front, and three behind the joint, remained open for the next two years. During ten months of this period, she could not lift her arm to her head, nor feed herself with it. In 1857, the sinuses had all closed, except one which discharged slightly, a little below the head of the radius,—a not uncommon situation of opening in disease of the elbow-joint. The patient's general health remained good, at least there was no approach to exhaustion. Having regard to the quiescent state of the joint, and the satisfactory state of the constitutional condition, it appeared probable that if sufficient power of nutrition could be evoked, ankylosis would ensue. The result more than fulfilled my anticipation. After three months' treatment, by rest, strapping with the emplastrum ammoniaci cum hydrargyro, tonics and diet,—my usual course of treatment for curable joint-disease; fibrous ankylosis had taken place effectually, and there was limited motion in the joint. Improvement gradually continued, and the range of motion increased. In 1861, the patient could roll paste without pain or inconvenience; she could lift a nine-gallon barrel of beer and set it on "thrall," and she could make a bed, shaking the mattress or feather-bed without affecting the elbow. Weather, or the east wind, sometimes gave her slight rheumatic twinges in the joint. In April, 1865, the joint was neither painful nor swollen; all the sinuses had firmly and permanently closed, leaving the bony outline of the natural articulation only somewhat enlarged and irregular in shape. She could flex the forearm to an acute angle with the arm, and both pronation and supination were perfect. The action of the hand and fingers completed the perfect use of the arm.

*The Conditions of Elbow-joint Disease appropriate for Excision.*—The three conditions which severally determine the propriety of excision with regard to the joints in general, are applicable to the elbow-joint.

(1) Functional inutility of the limb, depending on disease of the joint having resulted in destruction of the articular cartilages, without the supervention of ankylosis, will always justify excision; care being taken that the constitutional condition shall *not*, if possible, have approached to exhaustion. (Fig. 259.) But the degree of reserve power requisite for recovery is much less than after excision of the knee or hip, owing to the average period of reparation being less by one-half, or about six weeks instead of three months.

(2) Osseous ankylosis, and particularly in connexion with a useless position of the limb, will also justify excision.

(3) The structural conditions of disease pertaining to the elbow-joint, which specially affect the propriety of its excision, relate to the *extent of bone* destroyed by disease. The limits of excision of the elbow-joint are not restricted by two of the three considerations respecting the knee-joint. Thus, the length of the portions of bone removed from the



elbow is comparatively unimportant; the corresponding loss of length in the arm not much impairing the use of this member eventually, nor is it of consequence, therefore, to observe the epiphyseal lines as affecting the subsequent growth of the bones. But it is equally requisite in the

FIG. 259.



elbow as in the knee to preserve sufficiently wide surfaces for the formation of an adequately secure union; in the one case, with ligamentous mobility; in the other, with osseous consolidation.

The removal of only a thin superficial section of the articular ends of the bones in the elbow-joint, leaving the section ends too nearly in contact, is apt to be followed by osseous union and an unsuccessful result of the operation. On the other hand, any new bone which may not unfrequently have been produced in the form of a spiculated enlargement of the articular ends *above* their diseased portions, and thereby limiting the disease, should not be included in the excision. (Fig. 260.) The importance of observing this limitation of the operation is particularly urged by Mr. Butcher in his work on *Operative and Conservative Surgery*.

FIG. 260.



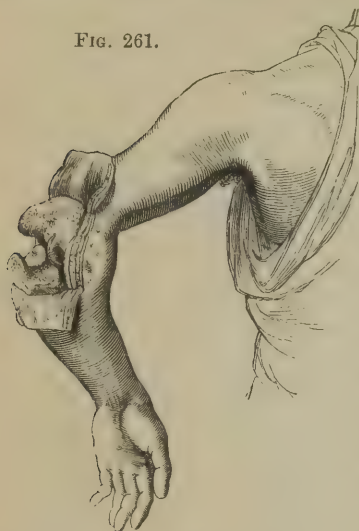
*Operation.*—Excision of the elbow-joint, for disease, was originally performed by Justamond, of the Westminster Hospital, in 1775,—as a partial operation, in which the olecranon and two inches of the ulna were removed; complete excision was first performed by Moreau, senior, in 1794, and by Moreau, junior, in 1797; but the operation attracted little attention until it was revived by Stansfield, Chorley, and Hey of Leeds, in 1818–19; and especially by Syme in 1830; since which period it has been more generally practised than the excision of any other joint for disease.



The operation is thus performed:—a single linear incision **I**, longitudinally over the centre of the joint, and of sufficient length to turn out the bones, is preferable to any other, in relation to speedy recovery after operation. Other forms of incision offer certain special operative advan-

tages. An **H** shape exposes the bones more readily, on reflecting the flaps, thus marked out, upwards and downwards; and this incision is particularly recommended by Sir W. Fergusson. (Fig. 261.) A **—** shaped incision with the vertical line parallel to and a little outside the ulnar nerve, allows of its being more surely guarded or drawn inwards, by a curved spatula in the hands of an assistant. In either case, the transverse line of these incisions should be made across the end of the olecranon from condyle to condyle; or nearly to the inner condyle, in the latter form of incision; and thus the joint is laid open. But the single longitudinal incision is now, I believe, generally practised, and I

FIG. 261.



rarely find any other more convenient. With a little detachment of the integument on either side, the knife is entered transversely above the olecranon, dividing the tendon of the triceps,—the ulnar nerve being protected; the olecranon process must then be sawn off transversely, and by forcibly flexing the arm, and, perhaps, dividing the lateral ligaments with a light touch of the knife, the articular surfaces of the three bones are fully protruded and exposed. The articular surface of the humerus, between the condyles, is excised by means of a small saw; and the remaining sigmoid surface of the ulna and head of the radius, in like manner, or removed with pliers, or simply gouged. The latter two bones should not be excised below the insertions of the brachialis anticus and biceps muscles; for thus

the brachial artery will be protected by the intervening brachialis muscle from any fair risk of injury, in removing these portions of bone. Any surrounding *out-growth* of bone, resulting from exuberant reparative action, must not be mistaken for disease; it should not be included in the excision. The line of incision having been closed with sutures, the arm is laid semiflexed on an angular splint; or it may be placed in Mr. Christopher Heath's splint, an apparatus which combines with rest and graduated flexion or extension, graduated elongation of the limb, and entire access to the joint for dressing. To ensure the formation of flexible union, passive motion should be gradually recommenced when such reparation is established; say, in three or four weeks.

*Results of excision of Elbow-joint.*—(1) In relation to Life, or the *Mortality*.—Three *general* conclusions may be drawn from the results of one large collection of cases; those, in the Hospitals of the United Kingdom, and in the practice of individual Surgeons,—(1) a lower mortality than that of any joint-excision in the lower extremity; and in the upper extremity also, so far as statistics hitherto collected supply the data for comparison. (2) An average mortality of 1 in 8, or 12 per cent.; or even much lower, about 1 in 15, or about 7 per cent. (3) A very different mortality in the hands of individual Surgeons.

The conditions of disease, local and constitutional, in the cases selected for operation, would seem to mainly determine this difference; while, the mode of performing the operation, and the after-treatment, would also contribute to explain it.

The collection of cases, by Dr. Hodges, amounts to 119; of these, 15 died, 1 in 8, or 12 per cent.

*Author's Collection.*

(1) Royal Infirmary, Edinburgh; period, 1865-69. (Per Mr. P. H. Watson.) Number of cases, 62; recoveries, 50; deaths, 12.

(2) Liverpool Royal Infirmary; period, last five years. (Per Mr. W. J. Cleaver.) Number of cases, 30; recoveries, 29; deaths, 1; amputation after excision, 1; recoveries, 1.

(3) St. Bartholomew's Hospital; period 1866-70. (Per Mr. Calender.) Number of cases, 19; recoveries, 17; deaths, 2; amputations after excision, 2; recoveries, 1; deaths, 1.

(4) Guy's Hospital; period, 1864-69. (Per Mr. T. Bryant, from Dr. Steel, Superintendent.) Number of cases, 19; recoveries, 17; deaths, 2.

(5) Chalmers Hospital, Edinburgh; period, last six years. (Per Mr. P. H. Watson.) Number of cases, 15; recoveries, 14; deaths, 1; re-excisions, 1; recoveries, 1.

(6) London Hospital; period, last five years. (Per Mr. McCarthy.) Number of cases, 14; recoveries, 12; deaths, 2.

(7) King's College Hospital; period, last five years. (Per the House Surgeon.) Number of cases, 12; recoveries, 11; deaths, 1.

(8) Westminster Hospital; period, last five years. (Per Mr. F. Mason.) Number of cases, 12; recoveries, 12.

(9) Charing Cross Hospital; period, 1860-65. (Per Mr. Hancock.) Number of cases, 8; recoveries, 8.

(10) St. Mary's Hospital; period, last five years. (Per Mr. Gascoyen.) Number of cases, 8; recoveries, 8.

(11) Royal Free Hospital; period, last seven years. Number of cases, 7; recoveries, 6; deaths, 1.

(12) Royal Sea-Bathing Infirmary, Margate; period, last five years. (Per Mr. J. R. Clouting.) Number of cases, 6; recoveries, 6; re-excisions, 2; recoveries, 2.

(13) St. Thomas's Hospital; period, 1866-70. (Per Mr. F. Churchill.) Number of cases, 4; recoveries, 4.

(14) Royal Albert Hospital, Devonport; period, last five years. (Per Mr. W. P. Swain.) Number of cases, 2; recoveries, 2.

(15) Great Northern Hospital; period, last five years. (Per Mr. J. Willis.) Number of cases, 1; recoveries, 1.

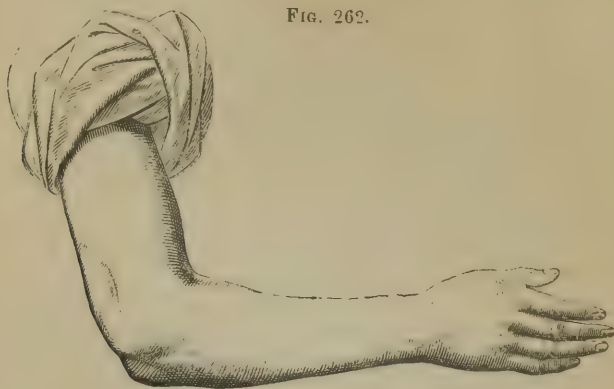
*Compared with Mortality of Amputation of the Arm.*—By Malgaigne's statistics from the Parisian Hospitals we find; of 61 cases, for disease, 4 deaths resulting, or 6·5 per cent.;—a *lower* mortality than that after excision of the elbow-joint. But the statistical results from University College Hospital, furnished by Mr. Erichsen, show a *far higher* mortality after amputation. Of 18 cases of amputation of the *shoulder* and arm, for disease; 5 died, or 27·7 per cent.

(2) *State of the Limb.*—Of the 104 recoveries out of 119 cases, the majority (*minus* 15 amputation cases) had useful limbs, as proved by the patient being able to resume his ordinary avocations; but the details



given respecting the kind and extent of motions left are not exact. The subjoined figure represents the resulting appearance of the elbow, and arm, after excision of the joint, in a case operated on by Sir W. Fergusson. (Fig. 262.)

Fig. 262.



The *average duration* of the process of recovery cannot be gathered from recorded cases. In about three weeks generally, passive motion may be commenced, and fibrous union be completed in six weeks; a more rapid progress by half the average period requisite for *osseous* union, after excision of the corresponding joint in the lower limb—the knee.

The resulting *state of the joint*, is commonly fibrous and flexible union, rarely osseous and fixed ankylosis; the former, of course, being the result desired. In an interesting case, which Mr. Syme had the opportunity of dissecting nine years after the operation of excision of the elbow, for injury; the ulna was found united to the humerus by ligament, while the end of the radius was polished off, and played on the humerus and ulna, a material like cartilage being interposed. The ends of the bones of the forearm were locked in by two processes projecting downwards from the humerus, and strong lateral, and still stronger anterior and posterior ligaments, also bound them to the latter bone. Dissections of several cases, after successful excision of the elbow, may be found in Wagner on “Repair after Resection;” and it would seem that the general result is,—union, by more or less extensible ligament. Flexion, according to M. Robert, is composed of two movements; the forearm being first drawn up to the humerus by the triceps, and then flexed by the action of the biceps. The joint becomes nearly as useful as the original articulation. Thus, in Mr. Syme’s case, the man—a railway guard, could swing himself from one carriage to another while the train was in motion, with the injured arm, quite as easily and securely as with the other; and in one of Mr. Butcher’s cases, the man could lift a bucket of water, holding four gallons, and carry it to and fro, or lift it on to a table three feet high. Then again, the freedom of the ankylosis for the more delicate movements of the forearm and hand, was well exhibited in one of my own cases (Case 1); a milliner and dressmaker who could work with her needle readily and untiringly,—a *seven years’ permanent result of excision*.

Injury of the ulnar nerve—an occasional accident during the opera-

tion—is followed by loss of sensation in the little finger and adjoining side of the ring finger, with perhaps loss of motion and wasting of the muscles; but the sense of touch will probably return, and the other ill-consequences cease, apparently by re-union of the wounded nerve. This accident, judging from the digital paralysis, happened apparently in one of my own cases,—that of the milliner just mentioned; but the symptoms passed off entirely, as the functional use of the finger showed.

*Re-excision* may be practised, as in the knee—when necessary, rather than resort to amputation; and even a third such attempt has, it is said, been made with good results. In my table of Hospitals, 219 cases; of the 197 recoveries from the primary excision, 3 only are noted as having undergone re-excision, but with no death. Of my own 5 cases, I had to re-excise 1, and with a thoroughly successful result,—the patient resuming his occupation as a postman.

*Secondary amputation.*—Of the 104 recoveries after excision, in Hodges' collection of 119 cases, 15 of that number underwent amputation subsequently. From the collection of Hospitals, we learn; that of the 197 recoveries, 3 only were subjected to amputation, with one fatal issue.

The following cases in which I excised the elbow-joint, for disease, are here grouped together, as exhibiting the most essential particulars relating to the question of this operation; and the permanent results are also stated. The notes from which I have drawn up these abstracts were carefully taken, excepting in the first case, by Mr. T. C. Murphy, Senior House Surgeon at the Royal Free Hospital.

TYPICAL CASES OF ELBOW-JOINT EXCISION.—CASE 1.—Margaret R——, æt. 25. *Chronic synovitis*, of traumatic origin, one and a half year's duration, one year and two months' treatment. *Partial ulceration* of the articular cartilages of the humerus, ulna, and radius; with semiflexed position of the limb. *Excision.* *Recovery*, with a moveable joint and useful limb, in six weeks. *Result known to be permanent after seven years.*

For the particulars of this case I am indebted to my colleague, Mr. John D. Hill, then Senior House Surgeon in the Hospital.

CASE 2.—Thomas H. B——, æt. 29. *Chronic synovitis* of traumatic origin, one year's duration and treatment. *Ulceration* of the articular cartilages of the humerus, ulna, and radius; with semiflexed position of the limb. *Excision.* *Recovery*, with a partially moveable joint. Subsequent formation of abscess and sinuses. *Re-excision.* *Recovery*, with a moveable joint and a limb useful, in flexion, extension, pronation, and supination. *Result known to be permanent after one year and four months.*

CASE 3.—Mary M——, æt. 28. *Acute synovitis* of traumatic origin, one month's duration. *Partial ulceration* of the articular cartilages of the humerus, ulna, and radius, with subjacent caries; a semiflexed position of the limb; *excessive* and *paroxysmal pain.* *Excision.* *Recovery*, with a moveable joint by passive motion, in six weeks. *Result known to be permanent after one year.*

CASE 4.—Jane T——, æt. 31. *Scrofulous caries* of the ends of the humerus and ulna in the elbow-joint. *Ulceration* of the articular cartilages, with semiflexed position of the limb. *Excision.* *Recovery* with a partially moveable joint by passive motion, in two months. *Permanent result, at the end of six months, uncertain.*

CASE 5.—Lewis P.—, æt. 50. *Caries* of the olecranon, of idiopathic origin, ten months' duration and treatment; idiopathic abscess opposite the outer condyle of the humerus, six years previously. Carious bone gouged out of the olecranon. The joint opened in this procedure. *Excision* of the olecranon and of the end of humerus. *Recovery*, with a moveable joint.

SHOULDER-JOINT.—Disease of the shoulder-joint occurs so much less frequently than that of other joints, as to considerably restrict the opportunities for clinical observation respecting its seat of origin; the probability of natural ankylosis ensuing, or the necessity for operative interference by excision to bring about that issue. The synovial membrane, in some cases, would appear to be the seat of the disease; and then—suppuration being a rare event, fibrous ankylosis usually ensues. But caries, in other cases, is the mode of origin,—affecting the head of the humerus, less commonly the glenoid cavity, or only secondarily and partially; and then natural ankylosis rarely takes place. Caries, external to the joint, as of the coracoid process, the acromion, or spine of the scapula, must not be confounded with disease of the shoulder-joint.

Thus, may be recognised as indications for operation, the following.

*Conditions of Shoulder-joint Disease, appropriate for Excision:—*

(1) When disease, commencing either in the synovial membrane, or as caries, has extended to and destroyed the articular cartilages, of the head of the humerus, or of the glenoid cavity of the scapula, or of both surfaces; without the supervention of ankylosis. The constitutional condition should not have advanced to exhaustion; although, in even an extreme state of hectic and emaciation, recovery after excision of the shoulder-joint is more probable than after such operation on any other large joint.

Necrosis of the head of the humerus, generally necessitates excision of this portion of bone; but sometimes, in central necrosis, the sequestrum can be extracted, without excision.

Caries or necrosis of the coracoid process, or of the acromion, is, of course, a condition of disease not requiring excision of the joint.

(2) Osseous Ankylosis, a rare condition, with perhaps mal-position of the limb, would scarcely ever justify the risk of excision.

The *amount of bone* to be removed is rarely extensive; the disease being limited usually to the head of the humerus, while the glenoid cavity is comparatively seldom affected, and even then may usually be left untouched, or only scraped.

*Operation.*—Excision of the shoulder-joint, for disease, is commonly said to have been originated by Mr. Charles White, of Manchester, in April, 1768. He had previously excised the head of the humerus on the dead subject; but the operation in question consisted in removing the upper part of the humerus for necrosis, leaving the head of the bone in the glenoid cavity. Similar excisions were performed by Vigaroux, of Montpellier, in 1767, and perhaps by David, of Rouen. Ridewald, in April, 1770, appears to have first removed the head of the humerus, for arthritic disease, the patient being a man, fifty years old, in a wretched condition of health; secondary amputation was resorted to for suppuration and hæmorrhage, and death ensued. This operation was followed in the next year, 1771, by another case; Mr. James Bent, of Newcastle, excised the head of the humerus for caries, of three years' standing, and with entire success. In the same year, the operation was performed

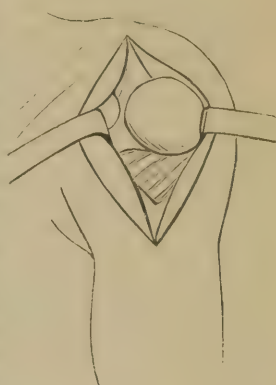


by Leutin; then in 1778, by Mr. Daniel Orred, of Chester; and in 1786, by the elder Moreau,—a complete excision of the head of the humerus, the glenoid cavity, and a portion of the acromion; the result being successful. Mr. Syme revived the operation in 1826.

An elliptical incision, **U**, is the best form of incision, as it exposes the joint most thoroughly for examination, and facilitates the application of instruments. Sometimes a **I**, or a **7** or a **T** incision may be preferable; and, in truth, the shape of the flap must be guided by the state of the integument with regard to sinuses or otherwise. Supposing an elliptical to be selected;—A bistoury is entered

FIG. 263.

at the posterior border of the acromion and carried down with a sweep across the insertion of the deltoid, upwards to the inner border of the coracoid process. The flap, embracing the deltoid muscle, is raised by a few touches with the knife; and, by slight adduction and rotation of the arm, the head of the humerus is turned out of the glenoid cavity,—the capsular ligament having disappeared. Or, the single linear incision may be made. (Fig. 263.) An assistant protecting the soft parts with a spatula on the inner aspect of the bone, the saw is applied below the diseased portion. The head, neck, and proximate part of the shaft may be thus removed; avoiding if possible the circumflex arteries. Any carious portion of the glenoid cavity may be scraped with a gouge. As a rule, with very rare exceptions, the glenoid cavity should not be excised. The flap is replaced, and retained by sutures; and the arm, with an axillary pad, may be bound to the chest, as for fractured clavicle; or supported on a pillow, extending as a splint from the axilla. Subsequently, the forearm must be supported in a sling.



*Results of Excision of the Shoulder-joint.*—(1) In relation to Life, or the *Mortality*.—Statistics are not, at present, sufficiently comprehensive to establish more than one general conclusion respecting this question. The average mortality appears to be 1 in 5, or 6; 20 per cent., or about 16 per cent., respectively. Of 50 cases, collected by Dr. Hodges, 8 died; 1 in 6, or about 16 per cent.; and in 7 of the 8 fatal cases, the glenoid cavity had been interfered with. Of the 30 cases in the Hospital collection below, the death-rate was nearly 1 in 4, or 25 per cent.

*Author's Collection.*

(1) Royal Infirmary, Edinburgh; period, 1865–69. (Per Mr. P. H. Watson.) Number of cases, 10; recoveries, 7; deaths, 3.

(2) Liverpool Royal Infirmary; period, last five years. (Per Mr. W. J. Cleaver.) Number of cases, 7; recoveries, 6; deaths, 1.

(3) London Hospital; period, last five years. (Per Mr. J. McCarthy.) Number of cases, 3; recoveries, 1; deaths, 2.

(4) Westminster Hospital; period, last five years. (Per Mr. F. Mason.) Number of cases, 3; recoveries, 3.

(5) St. Bartholomew's Hospital; period, 1866–70. (Per Mr. Calender.) Number of cases, 2; recoveries, 1; deaths, 1.

(6) Guy's Hospital; period, 1864-69. (Per Mr. T. Bryant, from Dr. Steel, Superintendent.) Number of cases, 2; recoveries, 2.

(7) St. Thomas's Hospital; period, 1866-70. (Per Mr. F. Churchill.) Number of cases, 1; recoveries, 1.

(8) Charing Cross Hospital; period, 1865-70. (Per Mr. Hancock.) Number of cases, 1; recoveries, 1.

(9) Royal Free Hospital; period, 1865-70. Number of cases, 1; recoveries, 1.

(10) King's College Hospital; St. Mary's Hospital; Great Northern Hospital; Royal Albert Hospital, Devonport; Chalmers Hospital, Edinburgh; Royal Sea-Bathing Infirmary, Margate; period, each last five years. No cases.

(2) *State of the Limb*.—In 4 of the 50 cases, collected by Hodges, the operation was unsuccessful; leaving a balance of 46 successful cases.

The *average period of recovery*, with some use of the limb, as calculated from 31 of the cases, was four months; "a much longer period, however, than this elapsed, before the limb could be said to become really serviceable."

The resulting state of the joint, would seem to be, that the limb can never be elevated above the horizontal line, while in many cases it hangs down, without any power whatever in the deltoid, at a greater or less distance from the scapula. But the movements of flexion, extension, and adduction are usually free; abduction can often be effected to the extent of raising the arm considerably from the side; and there is generally sufficient power in the *forearm* to carry heavy weights, and perform many of the ordinary domestic tasks. The arm is, therefore, a very useful one, irrespective of the vast importance of preserving the *hand*; and thus the person is enabled to follow many of the ordinary trades.

The following cases well illustrate the successful results of shoulder-joint excision, for disease. I have abstracted the first case from careful clinical notes by Mr. T. C. Murphy.

CASE 1. John C—, æt. 21. Admitted into the Royal Free Hospital, July 30th, 1870. The patient, of naturally good constitution, had never suffered from rheumatism; but for the last two years, he had habitually drank hard. At about the commencement of that period, he was struck with a stick on the right shoulder; three months afterwards, a small abscess formed at the anterior margin of the axilla, it was opened, and has continued to discharge ever since. The arm gradually became more fixed and drawn to the side. In the course of six months, a large abscess, the size of a fist, formed under the spine of the scapula; this was opened at St. Bartholomew's Hospital. Other abscesses have since formed; so that, on admission, the shoulder presented considerable enlargement, and seven sinus-openings—three posteriorly, two externally through the deltoid muscle, and two anteriorly in the angle of the axilla. From the date of injury, up to the present time, the joint has been painless, unless the arm was forcibly moved. The general health is much reduced by the profuse and long-continued discharge. I, therefore, endeavoured to restore the patient, as far as possible, constitutionally and locally, by a sustaining diet and rest of the joint; and, as he retrogressed occasionally, from attacks of diarrhœa, I postponed interference, watching the most favourable opportunity for operation. At length, after two months and a half of this manœuvring, on October 15th, I excised the joint; performing the operation by the elliptical incision, so as to embrace and raise the deltoid muscle, thus to thoroughly expose the whole joint. The remnant head of

the humerus was sawn through below the great tuberosity; observing my usual precaution, in all joint-excisions, not to detach the vascular connexion of the surrounding integument, and making the section just level with its attachment. The glenoid cavity, denuded of cartilage, was slightly scraped and freshened with a gouge. Torsion of one or two small vessels, and one ligature, sufficed to arrest the trifling hæmorrhage. The flap being laid down, and closed by a few points of suture, no retentive splint was applied; an axillary pad, and a bandage as for fractured clavicle, kept the osseous surfaces in apposition, and the arm on the chest. The wound healed throughout by primary union, discharging only from its angles, while the sinus-openings gradually dried up. The result, at the end of about six weeks, was, a freely moveable joint, in all directions—circumduction and rotation; with power to perform these movements, but only to a limited extent that of raising the arm by abduction horizontally. The general health had so far improved; that, regaining some flesh and strength, the patient became cheerful, and said “he felt better than he had done for years.” He left his bed daily. Subsequently, however, attacks of diarrhœa recurred from time to time, and the abdomen became tumid and tympanitic; enlargement of the liver, assumed to arise from amyloid or albuminous degeneration, was diagnosed by my colleague, Dr. Cockle—under whose care the patient has since remained. He died from this organic disease, on February 4th,— $3\frac{1}{2}$  months after the operation, from which he had entirely recovered, and with a freely moveable joint. P. M. examination verified the diagnosis, and preserved the articulation, as a perfect specimen of a new ball-and-socket-joint; an entire capsular ligament has formed, and the section-end of the humerus moves freely on the glenoid cavity of the scapula—in circumduction and rotation.

CASE 2.—E—F—, æt. 17, a young lady, the daughter of a practitioner well known in this Metropolis. I was invited by him (January, 1871) to witness the result in this case, and I am thus enabled of my knowledge to speak of its perfect and permanent success; at the same time, he communicated the following important particulars to me respecting its history:—Six years ago, when this young lady was between 10 and 11 years of age, she apparently took cold, while resting on a seat in Hyde Park. Her previous health having been always good, and as she had never received any injury to the shoulder, this was the only assignable cause of what took place. The right shoulder-joint became very painful, and acute inflammation set in, followed by free suppuration in 48 hours. Dr. Sibson saw the case, and then, by his recommendation, Mr. Samuel Lane, who immediately opened the abscess. It continued to discharge copiously, for two months; so abundantly indeed, that the father, who measured with an half-ounce spoon, the quantity of matter discharged from day to day, thus calculated that the patient lost during this short period, three gallons of pus. Her constitutional condition, accordingly, was much reduced. Then—two months from the date of apparent origin—Mr. Lane excised the shoulder-joint, assisted by Mr. James Lane, and Mr. Gascoven, Mr. Pollock and the father also being present. A longitudinal incision was made on the front of the humerus, apparently at the inner border of the deltoid muscle, from opposite the coracoid process downwards to about three inches in extent, and a short transverse cut superiorly; forming a T-shaped incision. Two inches and a half of the humerus were removed, and the glenoid cavity, in a deeply carious state, was freely gouged. The patient made an uninterrupted recovery;

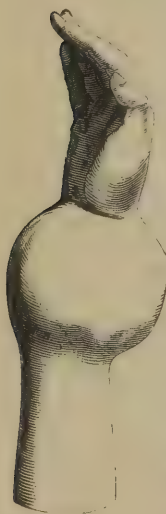


as reparation ensued, the appetite became voracious, and assimilation equally active. Nourishing food—meat, eggs, milk, with port wine, champagne, porter, &c., were taken eagerly at frequent intervals, by day, and even in the night. Being naturally intelligent, she declined any tonic medicine, as she felt her flesh and strength returning; her suggestive remark being,—“Which do you think will do me the most good, that which I like, or what I don't like?” The voice of Nature, thus proclaimed by Nature's child, was heeded. She made a complete recovery, and the result is—that, although the arm is four inches shorter than its fellow, she moves it freely backwards and forwards, without, however, the power to raise it horizontally, unless aided by the left hand. The motions of the forearm are perfect, so that she can work readily, write, or play the piano. The limb is, therefore, a most useful one, and this result has now been permanently established by six years' service.

**WRIST.**—Excision of the wrist comprises, properly speaking, not only the removal of the articulatory portions forming the radio-carpal articulation or wrist-joint, but also the carpus, and bases of the metacarpal bones; this extent of excision differing from that of the analogous operation on the ankle-joint, which is restricted to the removal of the articulatory portions of the tibia and fibula with that of the astragalus.

*Conditions of Wrist-disease appropriate for Excision.*—*Partial*, or *complete* disease of the wrist cannot be referred, like that of the larger and more simple joints, to an independent origin, either in the synovial membranes—three in number, or in the bones of the wrist. The lower articular end of the radius—and that of the ulna, which in relation to excision is associated with the wrist; the carpus below, consisting of eight bones, in two ranges of four in each; and the bases of the five metacarpal bones; are all so contiguous, as to obscure the precise seat of origin in caries affecting the wrist. Then again, the three synovial membranes are as one, in relation to the origin of disease in the form of

FIG. 264.



synovitis;—the membranous investment of the radio-carpal articulation, which sometimes communicates with that of the radio-ulnar articulation through a perforation in the intervening triangular fibro-cartilage; the investment between the two ranges of carpal bones, with its two prolongations upwards, and sometimes extending into the synovial membrane of the radio-carpal articulation, and the three prolongations downwards which always extend to and invest the four inner carpometacarpal articulations; and the separate synovial sac for this articulation in the thumb.

Caries of the wrist appears to be generally of scrofulous, and thence constitutional, origin—excited perhaps by some injury, of apparently trifling character, as a sprain; while synovitis seems to have another constitutional origin, probably as chronic rheumatism.

Thus, we recognise as conditions of disease for excision:—

(1) Scrofulous caries of the wrist; often involving the lower articular end of the radius, and ulna, the whole of the carpal bones, and the bases of the metacarpal bones, in a state of extensive caries. (Fig. 264.) This figure represents the wrist before excision of the lower end of the radius, in a case operated on by Mr. Hancock.

(2) Chronic synovitis, of perhaps more limited extent, but leading to caries and destruction of the articulations.

The *amount of bone* to be removed, as being apparently diseased, may vary according to the character and extent of the disease. Thus excision might include the lower ends of the radius and ulna, with the adjoining carpal bones,—in the wrist-joint; or, the bases of some or all of the metacarpal bones. But, Professor Lister insists on the complete extirpation of the wrist, in *all* cases,—from the lower ends of the radius and ulna to the bases of the five metacarpal bones, inclusive; the disease, however limited it may appear, being apt to recur in the articulatory portions left by a partial excision.

*Operation.*—Excision of the wrist was originally performed by the younger Moreau, at the close of the last century; subsequently, by a German Surgeon, Dietz, in 1839; and then again by Heyfelder of Erlangen, in 1849; but, in this country, the operation was revived by Sir William Fergusson, in August, 1851. Since that period, it has been resorted to by Mr. Simon, Mr. Erichsen, the late Mr. Stanley, and Mr. Butcher of Dublin; and practised especially by Professor Lister of Edinburgh, who has devised a particular method of operation,—for complete excision of the wrist.

*Partial excision*, consists in the removal of only one or two of the carpal bones, or other limited portions of the bones, forming the wrist. This procedure can be readily effected by slitting up any fistulous aperture leading to the carious bone, and extracting it by bone-nippers and forceps.

*Complete excision* may be performed in either of three ways. The choice of method is mainly determined by the consideration of difficulty in removing the affected bones, without dividing the extensor tendons of the fingers and thumb; the supinator tendons, radial and ulnar extensor tendons, inserted into the bases of metacarpal bones, being comparatively unimportant, in consequence of the firm fibrous ankylosis of the wrist after operation, if the result be successful.

*First method.*—A curvilinear incision is made, extending from just above the styloid process of the radius, downwards across the back of the wrist, and upwards to the same level above the styloid process of the ulna; the flap of integument is reflected, *carefully* avoiding the extensor tendons of the fingers, and those of the thumb, on the ulnar half of the radius. Then, dividing the supinator tendons, and the extensor tendons of the carpus, and flexing the wrist, the radio-carpal articulation is opened; and, while the other extensor tendons referred to are drawn aside with a curved spatula by an assistant, the articular ends of the radius and ulna, the carpal bones, and bases of the metacarpus, are successively removed by a small saw or cutting pliers introduced transversely.

*Second method.*—Two *lateral* longitudinal incisions are made, one on the ulnar, the other on the radial side, of the wrist, or on its *dorsal* aspect; thus *readily* avoiding the extensor tendons of the fingers, and that of the first joint of the thumb. The operation is then continued as before, and completed by excising the bones in the same manner.

A *single ulnar* incision is deemed sufficient by Sir W. Fergusson, and as the best mode of operation. (Fig. 265.) The resulting appearance is shown by the accompanying figure in Mr. Hancock's case. (Fig. 266.)

But Professor Lister has particularly pointed out, there are two

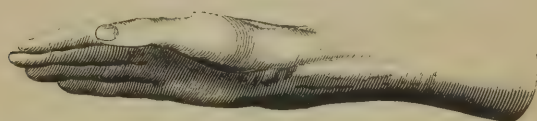
obvious and important objections to the lateral method, which somewhat resembles that which he has devised. Firstly, the radial incision is so placed, as probably to sacrifice the extensor tendons of the metacarpal bone, and of the second joint, of the thumb. Secondly, with regard to the

FIG. 265.



bones; that in the transverse division of the bones, an unnecessarily large amount of bone is removed from the radius and ulna and from the metacarpus,—a loss of length and breadth which interrupts the process of

FIG. 266.



consolidation, and results in a more narrow wrist and impaired strength of the hand. Moreover, that the bones being divided in the dark, some portion of the disease may probably be left behind.

To obviate these difficulties as to the excision of the bones, and to avoid the tendons requisite for the efficient use of the hand and fingers; another method of operation has been proposed and practised by Professor Lister. It consists in two essential peculiarities:—the radial incision is so placed, on the dorsal aspect of the radius, as to avoid the tendons which are otherwise liable to be implicated—the extensor ossis metacarpi pollicis, and the extensor secundi internodii; while the limited, but complete, excision of the bones is accomplished, by first removing the carpus, and then the articular ends of the radius and ulna, and the bases of the five metacarpal bones. This procedure is confessedly complicated in its detail,—“consisting of a series of operations, each one of which must be executed with scrupulous care,” and it demands accurate anatomical knowledge—an objection of no reasonable weight; the operation is also tedious to the Surgeon in its performance, and protracted for the endurance of the patient even under the influence of chloroform. These apparent objections, as to the nature of the operation itself and its performance, would, however, be entirely overruled by its more *successful* results, as compared with the simple procedures already noticed. How far *this* estimate may be in favour of the complicated method of operation, will be fairly shown by the comparative results of *both* in Mr Lister's practice.

But, in justice to a new operation, no less than to its originator, I



must first describe it; abridging the procedure as little as possible from his own description, although at the risk of proving somewhat wearisome, for all the details are urged as being found well worthy of attention.

*Third method, or Lister's operation.*—Chloroform having been administered, a tourniquet is placed upon the limb to prevent oozing of blood, which would interfere with the careful scrutiny to which the bones must be subjected. Any adhesions of the tendons are thoroughly broken down by freely moving all the articulations of the hand. The radial incision is then made. It commences above at the middle of the *dorsal* aspect of the radius, on a level with the styloid process, this being as close to the *angle* where the tendons of the *secundi internodii pollicis* and indicator meet, as it is safe to go. At first, it is directed towards the inner side of the metacarpo-phalangeal articulation of the thumb, recurring parallel to the tendon of the *extensor secundi internodii*; but, on reaching the line of the radial border of the metacarpal bone of the forefinger, it is carried downwards longitudinally for half the length of that bone, thus avoiding the radial artery which lies somewhat to the outer side. These directions will be found to serve, however much the parts may be obscured by inflammatory thickening. Next, the soft parts at the *radial* side of the incision are detached from the bones with the knife guided by the thumb-nail; so as to divide the tendon of the *extensor carpi radialis longior* at its insertion into the base of the second metacarpal bone, and raise it, along with that of the *extensor carpi radialis brevior* previously cut across, and the *extensor secundi internodii*, while the radial artery is thrust somewhat outwards. Then, the *trapezium* is detached from the rest of the carpus, by means of cutting-pliers applied in a line with the longitudinal part of the incision, but the removal of this bone is postponed until the rest of the carpus has been taken away, when it can be dissected out without much difficulty; the one procedure also not endangering the radial artery, the other having that risk. The soft parts on the *ulnar* side of the incision are dissected up from the carpus as far as may be convenient, the remainder being raised by the second or ulnar incision.

This incision, a free one, should commence at least two inches above the end of the ulna, immediately *anterior* to the bone, it is carried down between it and the *flexor carpi ulnaris*, and onwards in a straight line to the middle of the fifth metacarpal bone at its palmar aspect. The *dorsal* lip of this incision is raised, and the tendon of the *extensor carpi ulnaris* is cut at its insertion into the base of the fifth metacarpal bone, and is dissected up from its groove in the ulna, without isolating it from the integuments which would endanger its vitality. Then the extensor tendons of the fingers are readily separated from the carpus, the hand being bent back to relax them, and the *dorsal* and *internal lateral ligaments* of the wrist-joint are divided; leaving the connexions of the tendons with the radius undisturbed. The *anterior* surface of the ulna is cleared, turning the knife towards the bone to avoid the artery and nerve, the articulation of the pisiform bone is opened,—if not already done in making the incision, and the flexor tendons are separated from the carpus, the hand being depressed to relax them. To accomplish this, the process of the unciform bone must be clipped off with pliers, but the pisiform bone is left attached to the tendon of the *flexor carpi ulnaris*. In raising the tendons, the knife must not pass below the *bases* of the metacarpal bones, to avoid wounding the deep palmar arch. The *anterior ligament* of the wrist-joint is now divided. Then, introducing a pair of bone-forceps, the junction

between the carpus and the metacarpus is severed, thus completely detaching the *whole carpus*, which is extracted *en masse* with a pair of sequestrum-forceps,—leaving the trapezium and pisiform bones.

The ends of the *radius* and *ulna* are now made to protrude, from the ulnar incision, by everting the hand; and according to their state of caries on examination, the articular surfaces only, or a larger portion of the bones, should be excised. The end of the ulna may be sawn obliquely, removing the articular surface, but leaving the styloid process, and the ulna, therefore, of the same length as the radius; a provision for the subsequent symmetry and steadiness of the hand, the angular interval between the bones being filled by fresh ossific deposit. The end of the radius is then excised, by sawing off a thin slice, parallel to the general direction of the inferior articular surface. In doing this, the tendons in their grooves on the dorsal aspect of the bone need not be disturbed; it is sufficient to remove the bevelled ungrooved part of the bone-end, and thus the extensor secundi internodii pollicis may never come into view. This may seem a refinement; but the freedom with which the thumb and fingers can be extended, even within a day or two after the operation, when this point is attended to, shows its importance. The articular facet on the ulnar side of the radius is then clipped off with bone-nippers, applied longitudinally. In thus excising the ends of the ulna and radius successively, it is far better to take away too much bone than too little; a useful hand resulting in spite of very extensive excision. The *bases of the metacarpal bones* must then be examined and excised, saving as much bone as possible, but clipping off their articular surfaces transversely and laterally; even, when necessary, drilling the shaft into a hollow tube. The second and third bones are most easily reached from the radial incision, the fourth and fifth from the ulnar side. Next, the trapezium is seized with a strong pair of forceps and dissected out, carefully avoiding the tendon of the flexor carpi radialis, which lies firmly bound into the groove on the palmar aspect of this bone, and turning the knife close to the bone elsewhere to avoid wounding the radial artery. Then, having removed the trapezium, the base of the metacarpal bone of the thumb is pushed up and its articular surface clipped off; thus preventing the risk of recurrent disease, and reducing the thumb in length to the same extent as the fingers. Lastly, the pisiform bone should be examined, and its articular surface clipped off; the rest of the bone is left, if sound, as it retains the insertion of the flexor carpi ulnaris, and gives attachment to the anterior annular ligament; if unsound, the bone must be removed entirely.

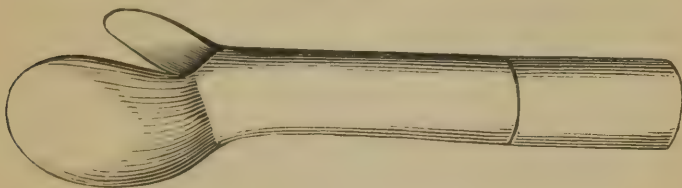
In this operation, the extensors of the carpus are the only tendons necessarily divided; the flexor carpi radialis, escapes, being connected with the second metacarpal bone *below* its base, and the flexor carpi ulnaris is left attached to the pisiform bone. All the flexors and extensors of the fingers, and all the extensors of the thumb, should be uninjured, and undisturbed beyond what is absolutely necessary for the operation of excision.

On removing the tourniquet, any hæmorrhage can be readily arrested by torsion or ligature. The radial incision is closed by sutures, and also the ulnar incision at its ends, leaving the middle portion open for the introduction of lint to allow free exit of the purulent discharge which necessarily ensues.

The hand is placed on a suitable splint, extending up the forearm, and

secured by a bandage. The most convenient form is an ordinary wooden splint, with an obtuse-angled piece of thick cork, cemented to the palmar portion by means of fused gutta-percha, and with a bar of cork stuck on transversely to the under-surface of the splint so as to project at the side. Lister's splint, thus constructed (Fig. 267), possesses certain important advantages. The hand lies semiflexed, which is its natural position of repose; the fingers are midway between flexion and extension, into which it is necessary to bring them by daily passive movements; while a certain range of voluntary motion is also permitted, which the patient should be encouraged to exercise frequently during the day. Then again, this position is best adapted for allowing the extensors of the carpus to acquire

FIG. 267.



fresh attachments; and, the palm resting on the sloping surface of cork, the splint cannot slip upwards; nor downwards, secured by turns of the bandage around the transverse bar of cork. This appendage to the splint specially keeps the *thumb* in position; it is thus allowed to fall below the level of the rest of the hand, so as to be most serviceable for opposition to the fingers; while the tendency to adduction of the thumb towards the index finger is prevented by a thick pad of lint placed in the angle between the two, under the turns of bandage around the transverse bar of cork. The palmar piece of cork should be hollowed out to receive the ball of the thumb.

*After-treatment.*—Two principles must be kept in view, in order to obtain a successful result. Firstly, to procure firm ankylosis of the wrist, by retaining it in a fixed position during the process of consolidation—for a period averaging six or seven weeks. Secondly, at the same time, to maintain the flexibility of the fingers and thumb, daily; commencing flexion on the second day, whether inflammation has subsided or not. In executing these movements, each finger should be both flexed and extended to the full degree, while the connected metacarpal bone is held quite steady, so as not to disturb the wrist. Both these principles are provided for by the peculiar construction of the splint, and Professor Lister attaches more importance to their fulfilment, in the after-treatment, than to his method of operation.

Pronation and supination, also, must not long be neglected; and as the new wrist acquires firmness; flexion and extension, abduction and adduction, should be occasionally encouraged. The period during which passive motion should be practised may be resolved into this rule—it must continue until the disposition to contract adhesions finally ceases—a few weeks or a few months.

When the patient leaves his bed, and carries his arm in a sling, the weight of the hand will make it gradually droop to the ulnar side; a tendency which is best counteracted by affixing two ledges of gutta-percha



to the ulnar side of the splint—one to support the border of the hand, and the other to prevent any lateral shifting of the splint. As the hand acquires strength, more free play for the fingers should be allowed, by cutting away the splint up to the knuckles, leaving only the palm supported. Some support must be continued until the patient feels the wrist as strong without it as with it. Earlier disuse of this support would assuredly undo the work of previous management, and lead to an unsuccessful result. A year, or even two, of such finishing-off support may be required to gain the most useful hand.

*Results.*—Fifteen cases of Wrist-Excision are recorded by Mr. Lister, as having occurred in his own practice. Of these cases, 12 were successful; recovery taking place, and with a hand more or less completely useful in its varied movements of the fingers and thumb, and with combined strength and flexibility of the wrist. In 1 case the result was doubtful at the time of the report—four months after operation. In the remaining 2 cases, death ensued, though not directly from the operation; one patient dying, at the end of seven weeks, from advanced phthisis and other complaints; the other patient, after re-excision about six months subsequent to the original operation, lived yet two months longer, when death occurred from phlebitis and pyæmia. Secondary hæmorrhage, or any other bad symptom immediately referable to the operation, occurred in not a single instance.

Thus, then, Lister's elaborate method of operation has been singularly safe and successful.

Other and simple methods of operation have hitherto rarely proved successful; the results having been, in the majority of the few instances recorded, either a stiff and useless hand, or recurrence of the disease and secondary amputation.

Yet, it may fairly be doubted whether the superior results attained by Lister's method have not been due—as he himself acknowledges—more to the principles on which the *after*-treatment was conducted, than to the plan and performance of the operation. This conclusion seems to be established by two significant facts in the history of Mr. Lister's cases—that the period of recovery and the resulting condition of the hand were about equal in his earlier and later cases, while the method of operation was different.

#### *Author's Collection.*

(1) Royal Infirmary, Edinburgh; period, 1865–69. (Per Mr. P. H. Watson.) Number of cases, 12; recoveries, 9; deaths, 3.

(2) Liverpool Royal Infirmary; period, last five years. (Per Mr. W. J. Cleaver.) Number of cases, 6; recoveries, 6.

(3) Chalmers Hospital, Edinburgh; period, last six years. (Per Mr. P. H. Watson.) Number of cases, 5; recoveries, 4; deaths, 1.

(4) London Hospital; period, last five years. (Per Mr. J. McCarthy.) Number of cases, 3; recoveries, 2; deaths, 1; amputations after excision, 1; recoveries, 1.

(5) King's College Hospital; period, last five years. (Per the House-Surgeon.) Number of cases, 3; recoveries, 3.

(6) St. Thomas's Hospital; period, 1866–70. (Per Mr. F. Churchill.) Number of cases, 1; recoveries, 1.

(7) St. Bartholomew's Hospital; period, 1866–70. (Per Mr. Calender.) Number of cases, 1; deaths, 1.

(8) Royal Free Hospital; period, last five years. Number of cases, 1; recoveries, 1.

(9) Guy's Hospital; Westminster Hospital; Charing Cross Hospital; St. Mary's Hospital; Great Northern Hospital; Royal Albert Hospital, Devonport; Royal Sea-Bathing Infirmary, Margate; period, each last five years. No cases.

THE HAND may often be subjected very advantageously to various operations of Excision, both in regard to the *Metacarpal Bones*, and the *Phalangeal Bones* of the Fingers.

The conditions of Disease appropriate for Excision, are precisely analogous with respect to any such operation on these bones of the hand, as in the corresponding bones of the foot. The articular ends, or the whole, of several, or of single bones, of the metacarpus or of the fingers, may thus be removed; instead of having recourse to amputation of portions of the hand, which would unnecessarily include sound portions of this precious member. But the choice of either operation of removal, and the plan and performance of the procedure, must be determined by the kind and extent of disease, in each particular case. The general principle, here again, applies; Pathology is the guide as to the excisional operation, whereby also the portion of the hand which may be preserved, is indicated.

#### EXCISION OF THE JOINTS FOR INJURY.

EXCISION OF THE KNEE-JOINT, FOR INJURY.—The operation of knee-joint excision, for injury to the joint, can only be appropriate in certain conditions, intermediate between those which admit of cure without any operative interference, and those which should be subjected to amputation of the thigh. Such injuries are more frequently too extensive, both in regard to the joints and surrounding soft parts, to admit even of excision; and must be submitted to amputation,—which operation, therefore, for *injury*, is an alternative procedure. But the constitutional condition will very probably be far more favourable in extensive injury, than in extensive disease,—the former occurring often to persons in high health, and not when the constitutional reserve-power, necessary for the long process of reparation after excision, has been reduced by long-continued pain or exhausted by discharge and hectic fever. Hence, this primary consideration with reference to the operation, as for disease, may probably be altogether omitted in selecting excision rather than amputation for injury to the joint. The question of operation arises more commonly in Military than in Civil practice.

*Conditions of Injury Appropriate for Excision.* — (1) Lacerated Wounds of the Joint. Punctured Wound may allow of closure, and the treatment for consequent synovitis. In the event of inflammatory disease, thus of traumatic origin, having terminated in destruction of the articular cartilages, without the supervention of ankylosis; the propriety of excision must be determined by the same consideration as with reference to idiopathic disease of the joint,—namely, the measure of constitutional reserve-power. (2) Compound Fracture involving the Joint. (3) Compound Dislocation of the Joint. (4) Gun-shot wounds of the knee-joint may comprise one or more of these conditions, with perhaps the addition, as a complication, of a foreign body in, or near to, the joint.

The operation is performed in accordance with the directions already

given, when the joint is diseased; the incision being modified conformably to the state of the integument in injury of the joint.

The *after-treatment* also is the same, as to the retentive appliances, and their reapplication from time to time, only as occasion may absolutely render necessary; but the more severe inflammation apt to arise after excision for injury, must be promptly met by more actively repressive measures.

*Results.*—Cases of knee-joint excision for injury have been far less numerous than for disease; and insufficient to establish any general conclusions, as to mortality or secondary amputation.

Cases of *lacerated* wound of the joint, for which the operation has been performed, have occurred; one in the practice of Mr. Kempe, of Exeter, the patient aged thirty, and the result perfectly successful, at the end of a year the patient being enabled to load a railway van; and in another case excision was resorted to by the late Mr. Price, as a secondary operation,—the patient six years old, having two months previously sustained an extensive laceration of the knee-joint by a cart-wheel, followed by profuse suppuration and burrowing sinuses, yet apparently the result was successful.

In a case of *punctured* wound of the knee-joint, by a needle, resulting in ankylosis and dislocation; at the end of one year and four months, Sir William Fergusson excised the joint; the patient recovering with a shortened but perfectly straight limb. In a similar case, under Mr. Erichsen, the patient recovered, with the natural cure by ankylosis.

Cases of *compound fracture* of the knee-joint, for which excision was practised have occurred; Dr. Watson having performed the operation in a case of compound, comminuted fracture of the patella, the fragments being impacted in the end of the femur, and the result of its excision, fatal: Mr. Crompton, in a case of compound fracture of the condyle of the femur, had a successful result to the operation; and, in a case of forcible separation of the lower epiphysis from the shaft of the femur, the patient being aged fifteen, sloughing ensued and protrusion of the end of the femur, for which Mr. Canton excised the joint, and with a perfectly successful result. In a similar case, the same Surgeon having performed excision, re-excision of a further protrusion of the femur was practised; and fibrous ankylosis with a useless limb resulting, Mr. Canton amputated the thigh, and the patient recovered.

*Compound dislocation* of the knee-joint will rarely admit of excision; owing to the extent of disorganization, amputation may be imperative.

*Gunshot* injury to the knee-joint, has not unfrequently allowed of excision, but the results have been far more frequently successful in Civil, than in Military practice. Successful cases have occurred; one at the London Hospital, under the care of Mr. J. Hutchinson; another, at the General Hospital, Birmingham, under Mr. Crompton; and M. Spillmann has collected the history of 13 cases of knee-joint excision in Civil practice, for gunshot injury, with only 3 deaths. On the other hand, under, probably, the less favourable circumstances of Military practice, the operation has been deadly. Of 21 such cases, collected by M. Spillmann, 19 were fatal. During the Crimean War, the returns of excision show only 1 case of excision of the knee-joint, and with a fatal issue. In the American War, the report from the Surgeon-General's department, records in a tabulated form, 770 terminated cases of gunshot wounds of



the knee-joint; in 11 cases of excision, only 2 recovered, or a mortality of 90 per cent.; whilst the mortality from amputation was far lower,—73·43 per cent., still a very melancholy record. Free incisions into the joint seem to have succeeded little better than excision. The results of the operation, as collected by M. Pénier, are very impressive. In Civil practice, of 7 cases; there were 4 recoveries, and 3 deaths, or 1 in  $2\frac{1}{3}$ ; whereas, in Military practice, of 20 cases, 3 only recovered, and 17 died,—an overwhelming mortality. All these cases are taken almost exclusively from Foreign sources. It would appear, therefore, that while excision of the knee-joint for injury, may be less successful than the average *minimum* success of the operation for disease: the mortality in Military practice is so excessive, as to suggest the propriety of there abandoning the operation in favour of amputation of the thigh.

*Author's Collection.*

(1) Great Northern Hospital; period, last five years. (Per Mr. J. Willis.) Number of cases, 2; recoveries, 2.

(2) St. Thomas's Hospital; period, 1866–70. (Per Mr. F. Churchill.) Number of cases, 1; deaths, 1.

(3) Royal Free Hospital; period, last five years. Number of cases, 1; recoveries, 1.

(4) Royal Infirmary, Edinburgh; period, last five years. (Per Mr. P. H. Watson.) Number of cases, 1; deaths, 1.

(5) Chalmers Hospital, Edinburgh; period, last six years. (Per Mr. P. H. Watson.) Number of cases, 1; deaths, 1.

(6) Guy's Hospital; St. Bartholomew's Hospital; London Hospital; Westminster Hospital; St. Mary's Hospital; Charing Cross Hospital; King's College Hospital; Liverpool Royal Infirmary; Royal Albert Hospital, Devonport; Royal Sea-Bathing Infirmary, Margate; period, each last five years. No cases.

EXCISION OF THE HIP-JOINT, FOR INJURY.—This operation, like that for the knee-joint on account of injury, relates more to Military than to Civil Practice. It was first performed, as reported by Oppenheim, at the battle of Eski-Arna-Utlar, between the Russians and Turks, on the 5th May, 1829. The injury was that of a gunshot wound of the hip, with fracture of the head and neck of the femur and of the upper edge of the cotyloid cavity; the soft parts being little injured, and the nerves and large vessels untouched. Death took place after the seventeenth day, apparently, however, from fright. The operation was advocated by Guthrie; and practised during the Crimean War, both in the English and French Hospitals.

*Conditions of Injury appropriate for Excision.*—(1) Compound Fracture of the upper part of the femur, and perhaps involving the acetabulum.

(2) Compound Dislocation of the Hip-joint—a rare form of injury.

(3) Gunshot Wound of the Hip-joint; comprising either of these conditions, and more often fracture. The diagnosis, as to the kind and extent of injury may be very difficult. Possibly, no shortening, eversion, or crepitus, and little loss of power to move the limb in flexion or extension; only a small aperture to be seen in the thigh, before or behind, with no hæmorrhage, and no pain experienced by the patient.

(4) Wrench of the hip-joint, a form of injury described by Brodie, has also been suggested as an appropriate condition for excision. But,

the impossibility of an accurate diagnosis in this case, would forbid so serious an operation.

The *operation* of excision for injury is performed in the same way as for disease, modified only by the state of the integument. *After-treatment* also requires no special notice.

*Results.*—In the Crimea; of the 14 cases of this operation in the English Hospitals, only 1 recovered; of the 13 cases in the French Hospitals, all were fatal; and in the Schleswig-Holstein campaign, of the 7 cases there was only 1 recovery.

The successful Crimean case had been operated on by Dr. O'Leary. A fragment of shell struck the great trochanter of the left femur, producing a fracture, which commenced close to the head of the bone, and extended downwards and forwards between the two trochanters, terminating about an inch and a quarter below the lesser. The external wound was small. The head of the femur and the trochanters were removed. In three months the man left his bed on crutches. At the end of six months, he had gradually regained the use of his limb, and, some time afterwards, was seen in London, in excellent health.

Although an almost invariably fatal operation, the duration of life after excision shows that it has no immediate danger. In the cases recorded; one of the patients lived 5 weeks, others from 6 to 17 days, and only 1 for so short a period as 22 hours.

On the other hand, natural recovery is almost hopeless. From gunshot wound of the hip-joint, one such result occurred after the battle of Solferino; and another was seen at Nantes, in 1830, by M. Boinet.

*Compared with Amputation at the hip-joint;* in Military practice, recovery very rarely ensues, death taking place usually within a day or two after this operation.

In the dilemma from the almost certain mortality of trusting to Nature, or performing amputation; the Surgeon may perhaps judiciously have recourse to the chance afforded by excision.

In the 15 Hospitals stated in previous Tables, respecting Joint-Excisions during the last five years; it appears, from the Returns with which I have been favoured, that there has been no case of excision of the Hip-joint, for Injury.

**EXCISION OF THE ANKLE-JOINT, FOR INJURY.**—This operation is referred to by Faure, as having been performed in a case which occurred at the Battle of Fontenoy; a wound of the ankle-joint by a "biscaien." The articular ends of the tibia and fibula, with the astragalus and portions of the other tarsal bones, were excised; but amputation was performed on the 47th day. Subsequently, excision of the articular ends of bone was performed by Mr. Cooper, of Bungay, for compound dislocation; the case being referred to in 1758, by Mr. Benjamin Gooch of Norwich. Cases, in which to the extent of two, three, and even four inches, the ends of the tibia and fibula were removed for injury, are related by Bilguer in 1781. Moreau, in 1792, performed this operation, with success, for compound dislocation, 19 days after the accident. In 1805, Park alludes to a case of excision of the tibial end for similar injury to the ankle; and, according to Mr. Hey of Leeds, in the same year, Mr. Taylor of Wakefield, had performed this operation in 5 cases. Sir Astley Cooper, Liston, and Malgaigne, have advocated removal of the ends of the tibia and fibula, in cases of compound dislocation, as being preferable to reduction or amputation. Mr. Jones of Jersey, performed complete excision—the

articular ends of bone and the surface of the astragalus, as a secondary operation; 22 days after compound dislocation with fracture of the malleoli, followed by necrosis, profuse suppuration, and constitutional disturbance. In about 3 months, the patient, having for ten days previously been able to walk some distance without support, ran away from the Hospital, and walked a distance of five miles with the aid of a stick and a crutch. A similar operation for a similar condition of the parts, was performed 5 months after the injury, by C. W. Klose, in 1854. The patient, 60 years of age, at the end of 10 weeks was able to walk out with a crutch.

*Conditions of Injury appropriate for Excision.*—(1) Compound fracture of the malleoli, with perhaps contusion of the bone.

(2) Compound dislocation of the ankle-joint.

In either of these conditions, it is presumed, that the ends of bone cannot be reduced, or if reduced, kept in position; and that the integuments are not so much lacerated or contused as to slough; unaccompanied also with comminution of the other tarsal bones.

The operation, and after-treatment, require no special notice.

*Results.*—In 29 cases, reported in Jaeger's tables, only 1 death occurred. Malgaigne records the unexceptional success of 5 operations by Taylor, 6 by Josse, and 9 by Sir A. Cooper.

*Compared with amputation of the leg, for injury,* the balance is highly favourable to excision. At Guy's Hospital, the mortality has been 62·5 per cent. in primary, and 66·66 per cent. in secondary amputations; while in the Royal Infirmary of Edinburgh, Mr. Syme records a mortality of 11, or 65 per cent., out of 13 amputations for compound dislocation of the tibia and fibula.

As to the state of the foot, after excision, the resulting condition has usually been ankylosis; but in some cases, reported by Sir A. Cooper, motion was preserved.

#### *Author's Collection.*

(1) London Hospital. Number of cases, 2; recoveries, 2; secondary amputation, 1; deaths, 1.

(2) Royal Infirmary, Edinburgh. Number of cases, 2; recoveries, 1; deaths, 1.

(3) Liverpool Royal Infirmary. Number of cases, 2; recoveries, 2; secondary amputations, 1; recoveries, 1.

(4) Guy's Hospital; St. Bartholomew's Hospital; St. Thomas's Hospital; King's College Hospital; Charing Cross Hospital; St. Mary's Hospital; Westminster Hospital; Royal Free Hospital; Great Northern Hospital; Royal Albert Hospital, Devonport; Royal Sea-Bathing Infirmary, Margate; Chalmers Hospital, Edinburgh. No cases.

In each of these Hospitals, the Period is that of the last five years; and the Returns were made to me by those Surgeons whose names are severally affixed in the previous Tables.

EXCISION OF THE SHOULDER-JOINT, FOR INJURY.—The contingencies of warfare render this operation far more common in Military than in Civil practice. It would appear from the French official report in the Crimea; that in open engagements, the superior extremity was wounded once in every 4·3, and in siege operations, once in every 6·2, of all wounds reported. Of 47 gunshot wounds of the upper extremity, 28 were of the shoulder and arm. The advanced position of the soldier's shoulder,



in the act of firing, exposes that part more particularly to bullet-wounds; while it also shares the liability of other parts to grape-shot, fragments of shell, and cannon-balls.

M. Boucher of Lille, seems to have first performed the operation of shoulder-joint excision, after the Battle of Fontenoy, in May, 1745. Subsequently complete excisions were practised successfully by Percy, Sabatier, Larrey, Lauer, Ingalls of Boston, Mann, Guthrie, Baudens, Hancock, and other Surgeons.

*Conditions of Injury appropriate for Excision.*—(1) Compound and comminuted fracture of the head and neck of the humerus.

(2) Compound dislocation.

(3) Gunshot wound, involving the head or neck of the humerus; extending down the shaft even into the medullary canal. Such fissures may be left, and recovery ensue; or, the shaft to the extent of four or five inches has been removed, with the head, and a successful result ensue.

Complications, by fracture of the glenoid cavity of the scapula, through the neck, or extending into the body, or involving the coracoid and acromion processes, may require the removal of such additional fragments, or they may be left to exfoliate; the result proving successful, although recovery be protracted. Thus, Larrey's case was remarkable for the extent of bone excised,—head of humerus, acromion, and proximate end of the clavicle; yet the patient recovered, and with considerable use of the arm.

Partial excision of the head of the humerus was practised in the Crimea. The after-mobility was more restricted, than as the result of complete excision.

A bullet imbedded in the head of the humerus may not unfrequently be extracted, without excision.

The state of the integuments, and of injury to the axillary vessels and nerves, will regulate the propriety of excision.

The *operation* is performed as for disease, modified only by the state of the integuments. The shape of the incision will be chiefly directed by the situation of the wound or wounds in the skin. A shattered shoulder from gunshot wound necessitates a sort of trimming-up excision; by enlarging the wound, and extracting splinters of bone. A perpendicular linear incision, from the acromion process downwards through the middle of the deltoid muscle, will probably suffice to expose the crushed head of the humerus. Removal of the disintegrated and splintered fragments must then be performed *secundum artem*.

*After-treatment* must be conducted on the same principle.

*Results.*—In 53 primary excisions of the shoulder-joint for injury, the mortality was 16. In 34 secondary operations, there were 6 deaths. Combining these two series of cases, and adding thereto, 6 operations with 3 deaths, by Baudens, and 3 others, successful,—1 by Langenbeck, and 2 by Textor, of which it is unknown whether they were primary or secondary; the total number is 96 cases, with 25 deaths, or a mortality of 26 per cent.

*Secondary* excision has a comparatively more favourable mortality than the primary operation. Thus, in the 53 primary excisions, the percentage was 30·18; whereas, in the 34 secondary operations, the percentage was only 17·64,—a balance of 12·54 in favour of the latter. More striking are the results reported by Esmarch. Of 6 excisions of

the head of the humerus, performed within twenty-four hours after the injury, 2 died; of three during the inflammatory stage, or on the third or fourth day, 2 died; whereas of 10 after suppuration was established, only the same proportion, 2, died. Of 26 patients in the ambulances of M. Baudens; 11 immediate excisions made 10 recoveries, 3 were submitted to secondary excision, and all were successful. In the Crimean returns, also, the cases were equally successful.

The *period of recovery* after shoulder-joint excision for injury, seems to be about two or three months in respect to treatment, the complete result as to usefulness of the arm not being obtained under twelve months, or a longer period. In the Crimea, the Schleswig-Holstein campaign, and the last Indian mutiny, many of the soldiers who had been thus operated on, returned to their regiments or to a modified duty, before the end of the war.

*Compared with natural cure*, excision has proved most favourable. Thus, of 8 cases suited for excision, but which were left to nature, 5 died, and the remaining 3, at the end of six months, were uncured. Of M. Baudens' cases, 15 were left to nature; 8 of these died from purulent infection, and 4 suffered long from fistulous openings,—the remaining 3 having undergone secondary excision.

*Compared with amputation* at the shoulder-joint, the results of excision are also favourable. In the Crimea, of 60 such amputations, 19 were fatal, or a percentage of 31·6; leaving in favour of excision, a balance of 5·6 per cent.

A curious comparison has been drawn between the results of excision on the right and left shoulder-joints. According to Esmaich, operation on the right side is more successful than on the left side; of the latter cases, 6 out of 12 having died, but only 1 out of 7 of right-shoulder excisions.

#### *Author's Collection.*

(1) Royal Infirmary, Edinburgh. Number of cases, 1; recoveries, 1.

(2) Royal Infirmary, Liverpool. Number of cases, 1; recoveries, 1.

(3) St. Bartholomew's Hospital; St. Thomas's Hospital; Guy's Hospital; St. Mary's Hospital; King's College Hospital; London Hospital; Westminster Hospital; Charing Cross Hospital; Royal Free Hospital; Great Northern Hospital; Royal Albert Hospital, Devonport; Royal Sea-Bathing Infirmary, Margate; Chalmers Hospital, Edinburgh. No cases.

In each of these Hospitals, the Period is that of the last five years; and the Returns were made to me by those Surgeons whose names are severally affixed in the previous Tables.

EXCISION OF THE ELBOW-JOINT, FOR INJURY.—This operation appears to have been first performed by Wainman, of Shripton, in 1758 or 1759; the case having been one of compound dislocation, the articular end of the humerus was removed just above the olecranon fossa, the patient recovered, and with a flexible arm, "as if nothing had ever been amiss." This operation is famous in the history of Excisional Surgery of the Joints, on account of its very early date. Subsequently, Tyre of Gloucester, excised two inches and a half of the lower end of the humerus, for a compound dislocation. Larrey urged this excision upon his Surgeons, but according to Percy, without much effect; "timidity, carelessness, routine, and indifference (words to be remembered) too often

led them to prefer amputation, even under the very eyes of the old chieftain of Military Surgery." In 1840, Mr. Alcock could find no instance of the *complete* excision of the elbow-joint, in the annals of either British or French Military Surgery. It was not until the Schleswig-Holstein War of 1848-51, that this operation was really introduced into Military practice, by B. Langenbeck of Berlin, and L. Stromeyer of Erlangen. Excision of the elbow-joint for injury is, indeed, more often required in warfare than in civil practice; though the nature of the injuries, and the circumstances of the patient after operation, may, as with regard to other joints, render the prospect of recovery less favourable in the one case than in the other.

*Conditions of Injury Appropriate for Excision.*—(1) Compound and comminuted fracture of the elbow-joint. (2) Compound dislocation. (3) Gunshot-wound, involving the joint.

Fissures of the humerus, just above the joint, more commonly extend downward than upward. The track of a ball near the joint often induces caries, which would ultimately require excision.

But the state of the integument, and of the brachial artery and the nerves, at the bend of the elbow, will regulate the propriety of excision instead of amputation.

The *operation*, and *after-treatment*, are analogous to that for disease.

*Results.*—In 12 cases of severe injury to the elbow-joint, reported by Mr. Jonathan Hutchinson, the results were decidedly in favour of excision, rather than of either natural cure, or primary amputation. An elbow-joint apparently preserved by the reduction of compound fracture or dislocation, is apt to entail profuse suppuration and constitutional disturbance, perhaps necessitating amputation of the arm; or the motion and consequent use of the arm eventually is less than after excision of the ends of bone. Both these conclusions are established by Mr. Hutchinson's cases; and the latter, as to the use of the arm, is confirmed by Macleod's report of the Surgery in the Crimean War.

In *Civil Hospitals*, the success of operation is very remarkable; of 21 cases, authenticated by Dr. R. Hodges, in his excellent treatise on Joint-Excisions, a rapid recovery ensued in all but one, the fatal result of which was in no way attributable to the operation.

*Compared with Amputation*, the mortality of excision contrasts very favourably. Of 13 amputations of the upper extremity, in Guy's Hospital, on account of injury, 1 in 4·33, or 33 per cent., of primary, and 1 in 5, or 20 per cent., of secondary operations, proved fatal.

In *Military Hospitals*, the results have been less successful, but still in favour of excision. Combining the experience of the Crimean War, and of the Schleswig-Holstein campaign, we have a total number of cases in proof of this position. Of 60 excisions, 11 were fatal, or a mortality of 18·33 per cent. Whereas, of 208 *amputations*, 48 were fatal, or a mortality of 23·07 per cent. Thence, a percentage of 4·74 in favour of excision. *Partial* excisions have not been so successful as the complete operation. This was shown in *civil* practice, by the results of 7 of the 21 cases referred to, where the partial operation was performed; 3 made good results, 1 ended in partial ankylosis, in 1 extension was imperfect, in 1, failure was imputed to habits of intemperance, and of 1 the result is wanting. *Military* practice, as taught by the results of the Crimean War, points to the same conclusion. Partial excisions of the elbow were more tedious in recovery, more liable to fail, and the results, when successful, were less perfect.



*Secondary* excision, at the period of suppuration, say at the end of a week, if it be not preferable to the primary operation, would seem not to be unfavourable to recovery. This is the opinion of Stromeyer, and it is confirmed by Esmarch's statistics—that of 11 excisions within the first twenty-four hours of the injury, 1 died; of 20 performed during the inflammatory stage—from the second to the fourth day, 4 died; of 9 secondary excisions in the period from the eighth to the thirty-seventh day, only 1 died.

The *right* elbow-joint, like the right shoulder, would appear to be more favourable for excision, in regard to recovery. On the right side, only 2 in 20 operations proved fatal; whereas, on the left side, 4 in 19 were fatal—a more than double mortality. Indeed, comparing the total results of the shoulder and elbow-joint excisions, the mortality on the left arm to that on the right is as 3 to 1.

*Author's Collection.*

- (1) Royal Infirmary Liverpool. Number of cases, 8; recoveries, 8.
- (2) London Hospital. Number of cases, 6; recoveries, 5; deaths, 1.
- (3) Royal Free Hospital. Number of cases, 2; recoveries, 2.
- (4) Royal Infirmary, Edinburgh. Number of cases, 2; recoveries, 2; secondary amputations, 1; deaths, 1.
- (5) Great Northern Hospital. Number of cases, 1; recoveries, 1.
- (6) St. Thomas's Hospital; Guy's Hospital; St. Bartholomew's Hospital; Westminster Hospital; St. Mary's Hospital; Charing Cross Hospital; King's College Hospital; Royal Albert Hospital, Devonport; Royal Sea-Bathing Infirmary, Margate; Chalmers Hospital, Edinburgh.

In each of these Hospitals, the Period is that of the last five years; and the Returns were made to me by those Surgeons whose names are severally affixed in the previous Tables.

EXCISION OF THE WRIST, FOR INJURY.—A partial excision of the wrist-joint—the radio-carpal articulation, appears to have been first performed, for injury, by Cooper of Bungay. “He sawed off the head of the radius, which passed through and made a dismal laceration of the tendons at the wrist, and the patient found little or no defect in the strength or motion of the joint.” Thus reported by Benjamin Gooch, in 1758, this operation was practised also by that Surgeon, who succeeded beyond his expectation in cases of a similar nature. At about the same period, M. Bagieu removed the comminuted bones of the wrist-joint, crushed by gun-shot injury; ankylosis ensued, and the fingers were left so flexible, that the patient, a soldier, aged twenty-five, was able to write and draw, and retained to a very considerable extent, the shape of the hand. About the year 1773, Bilguer excised some two or three inches of the wrist-end of the ulna, in a case of injury. In 1800, M. St. Hilaire of Montpellier, removed the ends of both radius and ulna, for compound dislocation, and with perfect success. In 1828, M. Hublier of Provins, performed the same operation, for similar injury accompanied with rupture of the tendons; and Huguier and Rossi repeated it for gunshot wounds of the wrist. Subsequently, excision was performed in the Crimea.

*Conditions of Injury Appropriate for Excision.*—The comparatively few cases recorded, with regard to excision for injury, are insufficient to establish any general conclusions. But, so far as experience has extended, and the analogy suggested by other joints, the following forms of injury to the wrist would seem to be proper for some such operation.

- (1) Compound and comminuted fracture.
- (2) Compound dislocation.
- (3) Gunshot wound, comprising either or both these conditions.

The complication of injury to the tendons at the wrist, does not forbid the operation; but the state of the adjacent vessels and nerves may be more important. Preservation of the hand, even in the most imperfect result for use, is so great a gain over the entire loss of this member, that the chance offered by excision will generally be preferable to primary amputation, at the wrist or in the forearm.

The *operation* and *after-treatment*, must be conducted on the principles laid down as for disease, modified only by the circumstances of the injury.

*Results.*—Some of the earlier cases have already been noticed. In the Crimea 3 cases of wrist-injury were submitted to excision, with 1 fatal result.

*Partial excision*, for compound dislocation of one or more of the carpal bones, has been practised occasionally, and with some success. Thus, Sir A. Cooper removed the scaphoid, and Malgaigne, the semi-lunar bone.

#### *Author's Collection.*

(1) London Hospital. Number of cases, 1; recoveries, 1; secondary amputations, 1; recoveries, 1.

(2) Royal Infirmary, Edinburgh. Number of cases, 1; deaths, 1.

(3) St. Thomas's Hospital; Guy's Hospital; St. Bartholomew's Hospital; King's College Hospital; St. Mary's Hospital; Westminster Hospital; Charing Cross Hospital; Royal Free Hospital; Great Northern Hospital; Liverpool Royal Infirmary; Royal Albert Hospital, Devonport; Royal Sea-Bathing Infirmary, Margate; Chalmers Hospital, Edinburgh. No cases.

In each of these Hospitals, the Period is that of the last five years; and the Returns were made to me by those Surgeons whose names are severally affixed in the previous Tables.

#### EXCISION OF BONES.

EXCISION OF UPPER JAW and LOWER JAW.—See DISEASES of the JAWS, Ch. XLIV.

EXCISION OF THE SCAPULA.—Complete Excision of this bone was originally performed by Cumming in 1808; afterwards by Gaetani Bey, 1830; and by Larrey, 1838; each of whom amputated the arm, and then excised the scapula; and more recently by Syme, Jones of Jersey, Cock, Fergusson, and Pollock, all of whom disarticulated at the shoulder-joint, leaving the arm untouched. The scapula, with the clavicle, have been removed by American Surgeons; by Massey, 1837; by McClellan, 1838; and both these bones, or rather the outer half of the clavicle, with the upper extremity, have been removed by Gilbert, in two cases; and by Massey, 1845. Partial excision of the scapula has been practised by Liston, 1819; Luke, 1828; and by Hayman, Janson, Wützer, Textor, Gross, and the Author. In these operations, the glenoid cavity was always left,—the only portion in Gross's case.

The *conditions of disease* for which excision of the scapula may be required, in whole, or in part; are caries or necrosis, and tumour.

The *results* of operation have been successful in the majority of cases,

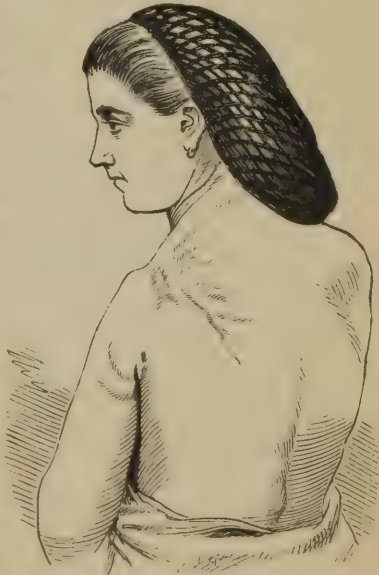
unless from the recurrence of the disease, and the arm has become very useful. Even the formidable operations of excision including the clavicle, and with amputation of the upper extremity, have proved successful.

*Operation.*—*Partial* excision of the scapula, for caries or a tumour, will require an incision, varying in shape and extent, according to the portion of bone, or the size and relative position of the tumour, to be removed; thus, the *body* of the scapula may be excised by a **T**-shaped incision, so placed as to correspond to the spine and middle of the body of the bone. The flaps having been well reflected, and the bone or tumour thoroughly exposed, the saw is applied below the spine and the neck of the bone, which is then dissected out of its bed. Hæmorrhage may be considerable, unless the subscapular or the dorsal artery be divided. The *spine* of the scapula may be readily exposed by an incision along its projecting border from the acromion, or to include this process if necessary. The bone is removed by a small saw or cutting-pliers, care being taken to avoid the joint, if the acromion be removed. Hæmorrhage will probably be considerable, no vessel of any consequence having been severed. I have thus removed this portion of the scapula with little difficulty. The *supraspinous* portion of the bone might be reached by a similar procedure.

*Complete* excision of the scapula may be accomplished by a similar operation to that for the removal of the body of the bone. A **T**-shaped incision, but extending from the acromial end of the clavicle to the posterior border, and vertically downwards to the inferior angle, of the scapula. The flaps, thus marked out, are to be well reflected; then, the acromio-clavicular articulation must be divided, or the adjoining portion of the clavicle or the base of the acromion may be sawn through, the muscles attached to the coracoid process must be divided, and the shoulder-joint opened, carefully avoiding the axillary artery and plexus of nerves on its inner aspect; lastly, the muscles attached to the superior and posterior borders of the bone are divided, with the supra-scapular and dorsal arteries, and the bone raised from behind forwards to the axilla, there dividing the subscapular artery in completing the severation of the axillary attachments. Or, the bone may be raised from the axilla backwards, dividing the subscapular artery in the first instance; a less convenient method of procedure, owing to the copious hæmorrhage. The vessels must be secured by ligature or torsion; and the amount of hæmorrhage may be perilous, in proportion to the vascular character of the tumour. The flaps of integument are replaced and retained by points of suture.

The resulting appearance after this operation, in a case by Jones of Jersey, is here shown (Fig. 268); and the usefulness of the arm is

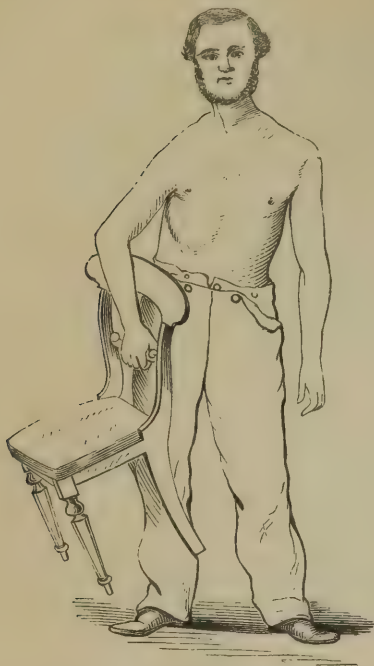
FIG. 268.





represented by the result of another complete excision of the scapula, by Mr. Syme. (Fig. 269.)

FIG. 269.



EXCISION OF SCAPULA, WITH AMPUTATION OF THE ARM AT SHOULDER-JOINT. — This formidable operation was originally performed, as already stated, by Cumming, 1808, and afterwards by Gaetani Bey, 1830, and by Larrey, 1838; all of whom operated for gunshot injury,—involving the arm, shoulder-joint, and scapula. A similar operation, for injury from machinery, is recorded by Mr. Patrick Heron Watson in the *Edin. Med. Journ.*, 1869. But this double operation,—excision and amputation, has also been performed *separately*, an interval of time elapsing between the former and the latter. Thus, Rigaud of Strasbourg, removed the scapula and also the outer extremity of the clavicle, eight months after amputation at the shoulder-joint. In two months the wound healed, and two years afterwards the patient still remained well. A similar operation was performed by Sir W. Fergusson in 1847, for

caries of the scapula; amputation of the arm at the shoulder having been performed three years previously, for similar disease. In the adjoining representations (Figs. 270, 271); one shows the lines of incision in the shoulder-stump; and the other the appearance of the shoulder, without the scapula, in 1864, or seventeen years after operation. The patient was still alive and well in 1870, twenty-three years after operation.

EXCISION OF THE CLAVICLE. — *Partial* excision of this bone, for necrosis, may be accomplished by an incision along the affected portion of bone, which lying subcutaneously, can be removed with tolerable facility. The sternal end of the clavicle has been excised on account of its pressing on the œsophagus, in a case of permanent dislocation backwards.

*Complete* excision of the clavicle, for an osseous tumour, may be undertaken in like manner, by an incision extending along the bone from end to end; but owing to the subjacent parts, the removal of the entire bone is a proportionately more formidable operation.

This bone has been wholly or partially excised by Mott of New York, 1828; Warren, Travers, Davie of Bungay, Curtis of Chicago, Cooper of San Francisco, and Syme.

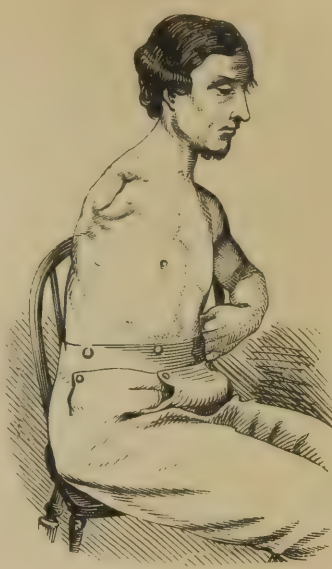
EXCISION OF THE RADIUS OR ULNA. — The bones of the forearm have each been subjected to excision, *partially* or *completely*. Thus, Dr. Butts of Virginia, and Mr. Erichsen, have removed the whole *radius*; in the latter case, the articular head of the bone, being sound, it was left. The

result was a useful arm. Carnochan of New York, and the late Mr. Jones of Jersey, excised the whole *ulna*, successfully. Sir William Fergusson

FIG. 270.

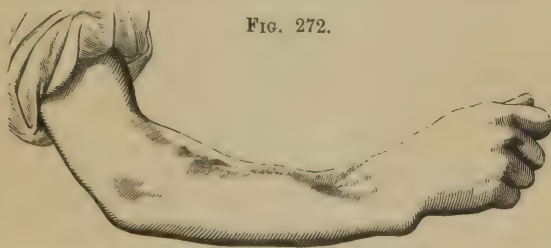


FIG. 271.



has also performed these excisional operations, and with entirely successful results, in the preservation of a useful arm. (Figs. 272 and 273.)

FIG. 272.



The one figure represents the appearance of the arm, after excision of the radius,—showing the cicatrix-line of incision along the place of the

FIG. 273.



radius; the other figure, a similar representation, of the cicatrix-line of

incision along the place of the ulna. Cases such as these were among those originally selected, by Sir W. Fergusson, in illustration of Conservative Surgery.\* But as exhibiting the guidance of the conditions of *disease*, in the design and performance of excisional operations on the joints, and bones; the term Pathological Operative Surgery, which some years since I suggested,† would seem to be more appropriate than that of Conservative,—which merely expresses the obviously implied object of all Surgery. The *guiding* principle referred to is far more important and significant; for Surgery must, necessarily, be conservative or preservative,—or, it is nothing. As representing the *Operative* character of this aspect of modern Surgery, in regard to the joints and bones; I have also designated it, simply, Excisional Surgery.

EXCISION OF THE TIBIA OR FIBULA.—*Partial* excision of either of these bones, in consequence of disease or injury, can be accomplished without much difficulty by simple incisions, varying according to the circumstances of the case.

*Complete* removal of the fibula was readily and successfully performed by Erichsen, for necrosis, in a child six years of age; the line of incision corresponding to the whole length of the bone. After such operation, an inner splint must be applied to obviate the tendency to varus which will ensue.

## CHAPTER XXXVIII.

### AMPUTATIONS.

GENERAL DIRECTIONS.—Amputation is the removal of any part of the body by a cutting operation of severation. This kind of operation relates chiefly to the Limbs. It may be practised for Injury or Disease; but amputation is performed in a *sound* part, more or less remote from the seat of the morbid condition; Pathology only *negatively* guiding the operation in the selection of that part, yet thereby materially affecting the result. [P. p. 832.]

The conditions of Injury or Disease, which necessitate Amputation, I have already considered in previous Chapters—especially with reference to Contused Wounds, Compound Fractures and Dislocations; it remains only to here describe the operations themselves—the how to do them.

Certain directions are common to all Amputations.

*Instruments.*—Few and of simple construction, amputating instruments and appliances comprise;—a tourniquet (Fig. 274) for preventing hæmorrhage by compression of the main artery, amputating knives of various lengths and shapes (see Figs. 275, 287), a saw (see Fig. 246), and cutting-pliers (see Fig. 152), the latter for removal of any spiculæ of bone; artery-forceps (see Fig. 39) or tenaculum, for seizing or hooking arterial vessels, ligatures (see Fig. 39) or acupressure-needles and wire (see Fig. 40) for tying or compressing them, suture-needles and silk or wire (see Fig. 31); strips of diachylon or isinglass plaster, and roller bandages, sponges and lint, with a supply of cold water, are of course included among the requisite surgical appliances. A few minutes' personal examination of these

\* Med. Times and Gaz., January, 1852.

† Med. Times and Gaz., August and July, 1865.



instruments will enable the youngest student to understand them far better than by any lengthened description. Some of the instruments are not absolutely necessary, or comparatively seldom requisite. A tourniquet may be dispensed with, provided pressure be made on the main artery by the thumb of a steady assistant. The advantages of a tourniquet are, that it compresses the smaller arterial vessels as well as the main trunk—the band portion encircling the limb, and that the compression of the pad is uniform and unfailing; the disadvantage is, that it also arrests the venous circulation, thus causing a greater loss of venous blood. This may be avoided by not screwing up the instrument tightly until just before commencing the operation. Cutting-pliers will not be required unless the bone be allowed to snap by dropping the distal portion of the limb, before the saw has passed completely through the bone. A tenaculum can be needed only where the artery must be “dipped” for; as an interosseous artery in the angle of two bones, just below the knee or elbow-joint, in amputations of the leg or forearm at these parts. Ligatures may be set aside if acupressure-needles be used; and possibly both dispensed with, by torsion of the vessels.

The instruments should be arranged on a small table or tray close at hand to the operator, or the assistant handing them to him; and he should *himself* see that everything is prepared before he begins the operation. This injunction applies equally to all Surgical Operations.

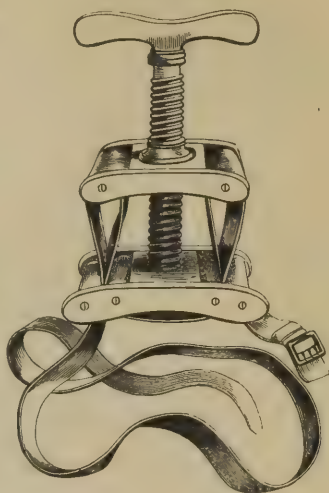
Assistants are required, varying in number according to the magnitude of the amputation; one assistant specially to administer chloroform, another to command the artery, a third to retract the flaps, and a fourth to support the limb, and, after its removal, to apply the ligatures as the arteries are seized by the operator. Thus the operation will be conducted in an orderly manner. In an emergency, fewer assistants will suffice, if they be instructed to do double duty.

*Operation of Amputation.*—Two forms of Amputation are practised; flap amputation by transfixion and cutting two flaps outwards, or one inwards and the other outwards, as regards the passage of the knife; circular amputation, by cutting from the skin towards the bone by a circular sweep of the knife, successively applied, with retraction of the divided integuments, or by two oval semicircular sweeps, progressing in like manner towards the bone. A combination of these two methods is sometimes practised; as by a single long flap on one aspect of the limb, and a transverse incision on the other side—Teale's amputation, or amputation by a long and a short *rectangular* flap.

The *flap* amputation will be described so thoroughly in particular amputations, as of the thigh, that it would be superfluous to introduce it here.

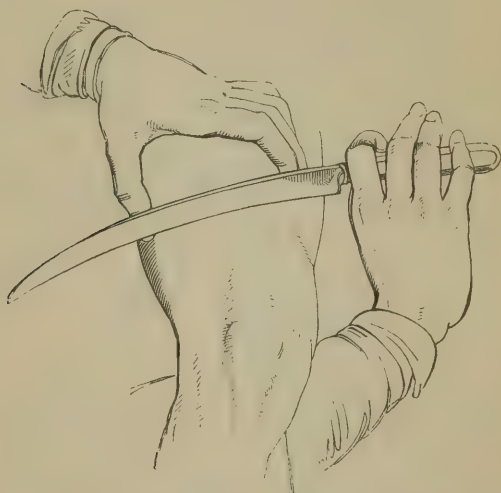
The *circular* amputation may be conveniently noticed once for all.

FIG. 274.



The preliminary arrangements having been made as for a flap amputation, the Surgeon stands in the relative position necessary to grasp the thigh, for example, with his left hand just below the part where he is about to amputate; the integuments must then be drawn up by an assistant who grasps the limb with both hands. Holding the knife lightly, but securely, the operator passes it under the thigh, bending his hand back until the edge of the knife lies on the inner and anterior surface of the thigh. (Fig. 275.) Sinking the edge through the *skin*, he carries it deliberately round under the limb, and then over it, gradually changing the bend of the wrist, until the hand is as much inclined forwards as it was in the opposite direction; and thus completes a circular incision. Whatever be

FIG. 275.



the extent of retraction produced, the integuments should still be drawn upwards, evenly around the limb; the knife is again applied as before, at the line of retracted integuments (Fig. 276), and made to sweep round the limb, passing half an inch or more through *aponeurosis* and superficial muscular fibres. The assistant, continuing to draw upwards, presents a fresh surface high up, and passes his hand down into the wound to secure the surface already gained; a third time, the knife is made to encircle the limb, at the upward line of the second incision, dividing the *muscles*, large blood-vessels and nerves, down to the bone. Retraction being continued by the assistant, some muscular fibres may be made to appear, attached to the bone for an inch or more above the line where the knife first touched the periosteum; these are divided with the point of the knife. The saw must then be applied at the highest part where the bone is thus exposed, and the bone sawn across transversely; the saw being worked freely from point to heel and not fiddled irregularly. In making retraction deep towards the bone, it will generally be requisite or advantageous to employ a retractor—a broad piece of linen with a longitudinal slit in it; this appliance proving more efficient than the fingers. In practising circular amputation on the dead subject, the flaccid state of the muscles, as contrasted with their

tonicity during life, even under the influence of chloroform, will render it unnecessary to employ a retractor or to use the more forcible manual retraction, above directed ; but this difference only affords another illus-

FIG. 276.



tration of the general distinction between operations on the dead and the living. [P. p. 834.]

On allowing the integuments and muscles to fall down and regain their position ; a conical cavity is formed, sloping gradually from the circular line in the skin, as the base, up to the bone, as the apex of the cone ; presenting a loose but fleshy stump. The vessels are secured, and the integuments adjusted by sutures, as in the flap amputation.

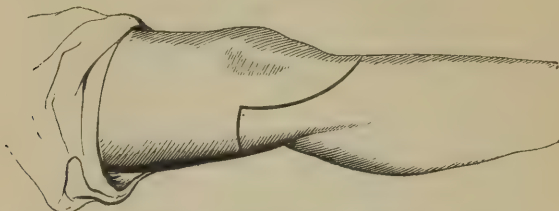
The *relative merits* of these two methods of amputation have been much discussed ; and some Surgeons have practised almost exclusively the one, and some, the other operation. Mr. Liston advocated flap amputation, and Sir W. Fergusson seems to prefer it, although fully acknowledging the good results of circular amputation in the hands of many excellent Surgeons. I am a disciple of the former distinguished Surgeon, originally as my teacher ; and having performed the flap amputation almost invariably, for many years, with ease and the production of permanently good stumps, I am inclined to recommend its general adoption. These two methods of amputation may perhaps be thus estimated ;—flap amputation is decidedly more easy of execution ; circular amputation has sometimes the advantage of a more successful result in a good stump. Both, however, may prove equally satisfactory in this respect, with care during the operation, in the formation of the stump, and in the subsequent dressing. Flap amputation is decidedly superior at any joint ; and circular amputation in the continuity of a bone, when the limb is unusually fleshy. I have sometimes overcome the difficulty of redundant flaps, by passing the knife above and below the bone, in making the flaps, so as to leave a wedge-shaped portion, and thus reduce their bulk.



*Amputation by a Long and a Short Rectangular Flap—Teale's Operation.*—The object of this method of amputation is twofold—to procure a more useful stump, and to diminish the mortality of the operation. Accordingly, the long flap is formed from that side of the limb which does not contain the principal blood-vessels and nerves, and is made long enough to fold easily over the end of the bone, its length and breadth being equal to half the circumference of the limb; while the short flap is one-fourth its length, and contains the vessels and nerves divided transversely. No dressing is used, and the stump should not be lifted for many days.

*Carden's Amputation at the Knee-Joint* is designed on the same prin-

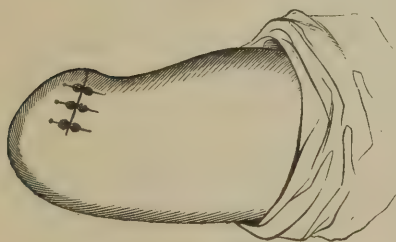
FIG. 277.



ciple, the incisions (Fig. 277) being similar, and the stump as here represented. (Fig. 278).

The alleged advantages of this method are, the prevention of tension by the ample size of the long flap; that, folding over the end of the bone, the flap soon acquires organic union therewith, and closes up the exposed veins; that, the limb remaining undisturbed by lifting and dressing, early closure of the veins is thus also favoured; that the end of the bone is covered by a flap free from large nerves and blood-vessels, and that the cicatrix does not adhere to it. The disadvantages

FIG. 278.



are, the necessity of sawing the bone at a higher point when one long flap only is made, than when two shorter ones of more equal length are fashioned—thus violating the established rule of not removing a limb at a higher point than is absolutely necessary, and impairing also the utility of the stump whenever its length may be a consideration of consequence. In

many injuries, with much damage to the soft parts, the operation would be impracticable, and the increased danger of a higher amputation would have to be encountered. In malignant or other recurring disease, the risk of recurrence in the long flap would be far greater than in two shorter ones, the bone being sawn at the same level. If primary union fail, the bulging of the large anterior flap will be more unmanageable than that of two smaller flaps.

*Dressing of a Stump.*—The general plan of putting up a stump, and after-dressing, is as follows:—Supposing, for example, it be a stump of the thigh, the flaps or wound should be well cleansed of any blood or chance foreign matter, by gently sluicing the surfaces with cold water

squeezed from a sponge, a basin catching the streams underneath the stump. Or, a weak solution of carbolic acid may be used, in like manner, as an antiseptic. The surfaces must then be adjusted, so that the edges lie evenly and easily in contact when brought together. Any ligatures, or acupressure wires, when they are used, should be drawn out at the nearest angle of the wound, and gently held under the finger of the assistant in charge of the flaps. Sutures or stitches are employed to retain the edges in apposition. Commencing most advantageously, for equal shaping of the stump, by introducing the first suture-needle in the middle of the stump, it should transfix either lip at about half an inch from the margin, so as to bring together a sufficient thickness of integument to support the flaps and induce primary adhesion. The thread is drawn through, and tied, without slipping, in a double knot, and the ends snipped off close to the wound. Other sutures are introduced in like manner, on either side of the first; and as many as may be necessary—no more, to keep the flaps together throughout the line of union. At one or both angles of the wound, as may be convenient, the ligatures having been collected, are protected from disturbance by a small strip of plaster overlaying them. Strips of adhesive plaster are drawn around the end of the stump, in the intervals of the sutures, thus further supporting the flaps and favouring adhesion. A strip of lint, soaked in water, or smeared with spermaceti ointment, or carbolic oil, is laid along the whole length of the wound, and a roller applied so as to encase the stump, but with a very moderate degree of pressure. Sometimes, a hæmorrhagic tendency is evinced by oozing of blood; the roller should then be applied more tightly for a time, or a compress of lint above and below the flaps may be advisable as an additional support and security, in putting up the stump.

On placing the patient recumbent in bed, the stump should be elevated on a pillow, and, no hæmorrhage supervening, it should be left undisturbed for some days—two, four, or six days, according to the degree of tension, the appearance of discharge, and atmospheric conditions as to temperature, or otherwise. Meanwhile, any liability to disturbance by spasmodic jerking of the limb may be controlled by a roller turned once round the stump and secured to either side of the bed. Opiates may also be administered, if necessary, for this purpose, and to procure sleep.

*Re-dressing* the stump must be done gently; the roller slit up with scissors, and the strips of plaster removed and replaced one by one, leaving those that still retain a good hold, and probably all the sutures. Care must be taken not to disturb the ligatures. A fresh strip of lint dipped in water—water-dressing, is reapplied, or a solution of carbolic acid, as an antiseptic, and over all, the support of a roller, lightly and evenly applied, will still be requisite. Subsequent dressings may be reduced and made yet lighter, their re-application having regard especially to the counteraction of any tendency to *bagging* by the collection of matter. Ligatures should be removed as they loosen from time to time; or acupressure-needles may be withdrawn in three or four days after amputation.

Any modifications of these proceedings, or further details, will be suggested by a general knowledge of the management of Wounds.

*Morbid Conditions of, or affecting, the Stump.*—(1) *Secondary Hæmorrhage.*—Hæmorrhage is named secondary when it occurs after an interval of a few hours, more or less, subsequent to an injury. It may arise from local or constitutional causes. *Local* causes comprise misapplication of a

ligature, as when, not having been applied transversely, or when, having included some surrounding texture, it shifts its position or loosens; a collateral branch just above the ligature may be the source of hæmorrhage, if wounded, or lead to hæmorrhage from the ligatured vessel by disturbing the formation of a clot; in the one case, hæmorrhage occurs soon after ligature; in the other when it separates; a diseased state of the coats of the artery ligatured is also followed by hæmorrhage. *Constitutional* causes include reaction after the stump has been put up, many vessels not bleeding at the time the main trunk was ligatured, and even this vessel will not bleed in a state of great collapse; excessive reaction has the same effect; an aplastic state of the blood will delay and impair the formation of clot within the vessel; and blood-poisons also have this effect, or by inducing erysipelas or sloughing of the wound, the result is the same—secondary hæmorrhage.

The *phenomena* of such hæmorrhage are not, as with primary arterial hæmorrhage, a jetting stream of florid blood; but, after a while, the blood wells up from the wound, and oozes through the dressings, then ceasing perhaps, it recurs again in a few hours. A stump should, therefore, always be watched for some time after amputation; and in the event of blood oozing, its continuance should be tested by sponging the part dry and overlaying it with a piece of dry lint, so as to detect any further escape. The *period* when secondary hæmorrhage occurs is variable; separation of the ligature is always a time for vigilance.

*Treatment* must have reference to the presumed cause of hæmorrhage, as mainly determined by the period of its occurrence. *Early* secondary hæmorrhage—within a few hours or days, may generally be suppressed by elevating the stump, and the application of cold and pressure to the flaps, a compress above and below being used and the bandage tightened. This failing, the stump must be opened up, the vessels sought for and tied, and the flaps replaced when the bleeding is controlled. *Later* secondary hæmorrhage—after ten days or a fortnight, proceeds more probably from the main artery in the stump; a ring tourniquet applied to that vessel above the stump will perhaps arrest the bleeding: this failing, the stump may be opened up, the coagula turned out, and the vessel sought and tied; or a ligature applied to the vessel above the stump. The choice between these two latter proceedings should be determined by the state of the stump—not as regards the soundness, but the unsoundness of the union. In the one case the vessel should be sought *in situ*, in the other, *above* the stump. Ligature *high up*, as by the Hunterian operation, may even thus be requisite. In the event of any failure in arresting the hæmorrhage, these different proceedings should be had recourse to *successively*.

(2) *Necrosis*.—Death of the end of the bone, and a resulting sequestrum or exfoliation may occur; either from injury to the bone by rough use of the saw; or in consequence of suppuration, sloughing, and exposure of the bone. The dead portion must be removed, when loosened.

(3) *Conical Stump*, with protrusion of the bone.—This morbid condition arises; either from insufficient coverings of the bone, at the time of amputation; or from spasmodic retraction of the muscles, subsequently. In either way, the bone protrudes, and the stump has, or acquires, a conical shape upwards from the bone as its *apex*. Sometimes, the bone threatens to protrude under a thin ulcerative cicatrix, which is unable to bear the slightest pressure or motion.



The protruding or projecting portion of bone must be excised, and the stump re-fashioned. An incision on the side opposite to the vessels should fairly expose the bone, which is then sawn off, and the flaps readjusted. In an extreme case, amputation of the stump must be resorted to.

(4) *Neuralgia* of the stump may arise from local or constitutional causes. Commonly, it arises from a more than usually bulbous enlargement of the ends of the nerves in the stump, or from adhesion to the cicatrix. Excision of any such enlargement will be necessary, or subcutaneous division of the cicatrix will be appropriate in the latter case. Excision of the end of the bone may be requisite, to relieve pressure and tightness arising from that cause. In a case of painful cicatrix after Chopart's operation; I divided the cicatrix subcutaneously without much effect; but at a later period, I removed the subjacent portion of the astragalus, with a perfectly successful result. The tendo-Achillis had been divided, to overcome retraction of the stump and tilting forwards of the astragalus under the cicatrix. An hysterical constitutional condition not unfrequently causes neuralgia and spasmodic twitchings in the stump, especially in females. No operative interference will be of the slightest use; and this condition must be treated, as best it may, constitutionally.

*Healthy Stump.*—Certain structural changes ensue in a healthy stump, and whereby it presents ultimately an altered appearance. The ends of bone or bones become rounded at their extremities, and the medullary canal occluded. The vessels are obliterated up to the nearest collateral branch, and the ends of the nerves have undergone some bulbous enlargement, consisting of dense fibro-cellular tissue and scattered nervous fibrillæ. The muscular portions of the flaps, however ample at first, are wasted and transformed into fibro-cellular texture connected with the skin, which chiefly forms the covering to the bone. The stump is thus reduced in size and somewhat pointed or conical; the rounded end of bone being plainly felt under the finger. The practical inference from this structural result is; that bulky muscular flaps are useless, and that the skin should be made of amply sufficient length to form the integumental covering of the bone.

*Artificial Limbs* of various kinds have been invented, suitable to the use of the part removed; and the most useful forms are figured in connexion with the result of each Particular Amputation.

**DOUBLE AMPUTATION.**—Amputation of two limbs, simultaneously or in immediate succession, may occasionally be required for severe injury, and sometimes for disease, as gangrene. The lower extremities are more frequently subject to double amputation, as when both thighs are crushed by the passage of a railway-truck across them; or one leg and one arm may have to be removed; but both arms seldom require amputation. I have had occasion to amputate both lower extremities, below the knees or in the thighs, in some instances; or the lower extremity, in the thigh, and the upper at the shoulder-joint; but I cannot call to mind having had occasion to amputate both arms.

The choice of simultaneous or subsequent amputation, must be determined by the state of shock to the nervous system and the circulation. The object of simultaneous amputation is to lessen the repetition and persistence of shock, by making it the shock, as it were, of one operation. But, the reserve-power of the system to sustain this single more severe

shock, must be judiciously estimated; and if subsequent amputation be deemed the safer course, the period of interval between the two operations—amputation of one limb, and then the other, should be regulated by the same consideration. In simultaneous double amputation of the lower limbs, Lister's tourniquet for compressing the abdominal aorta, offers the advantage of allowing the immediate succession of the second operation, without waiting to ligature the vessels in the first stump,—a procedure which involves no shock to the system.

RESULTS OF AMPUTATION.—The *mortality* after Amputation may be *primary*,—from shock; or from *secondary* causes,—principally, secondary hæmorrhage, exhaustion, tetanus, pyæmia, phlebitis, erysipelas, and pneumonia, or other visceral affections, and from affections of the stump, as sloughing, and Hospital gangrene.

The *causative conditions* which give rise to and induce these immediate causes, necessarily relate; (1) to the constitutional conditions, and age, of the individual; (2), to hygienic conditions; (3) to the operation;—as for injury or disease, the kind and extent of either, the period after injury,—representing primary and secondary amputations, the seat of amputation in its proximity to the trunk, and the structure of the bone sawn through, as involving or not the medullary canal.

(1) *Individual conditions*.—*Constitutional* states of health, whether hereditary or acquired, have a most powerful predisposing influence on the mortality after amputation, as after operations in general. A naturally *weak* constitution; in regard to the nervous system, the quality of the blood, as in the scrofulous diathesis, and the vigour of the circulation and of nutrition, predisposes severally, to the severity of shock contingent on the operation, to passive hæmorrhage, and to exhaustion. An acquired state of the general health, of similar character, in consequence of habits of intemperance and a hard life, resulting in a *broken* constitution, has the same unfavourable influence after amputation. Of *organic* diseases, the one which has perhaps the most fatal tendency, is Bright's disease of the kidneys, with albuminuria; a disease whereby the blood becomes drained of its albuminous or reparative plasma, and poisoned by the retention of urea or excrementitious matter. *Age* affects the result of amputation; the probability of success being in favour of an early period of life, and declining as life advances. In the one case, death occurs more frequently, by the exhaustion consequent on acute inflammatory fever, soon after the operation; in the other case, exhaustion from shock or from blood-poisoning, soon after the operation or at a later period.

(2) *Hygienic conditions* relate principally; to an impure atmosphere,—or as arising from deficient ventilation, defective drainage, or want of personal cleanliness, and to zymotic influences; also to the food, in respect to its quality and quantity. It is mainly on account of impure atmospheric conditions that the mortality from amputations in large towns contrasts unfavourably with those in the country. And, the causes of death are different; in towns, exhaustion, tetanus, pyæmia, erysipelas, and hospital gangrene; in the country; hæmorrhage and acute inflammation. But there is reason to believe that the principle now observed in the best Metropolitan Hospitals,—the segregation instead of the aggregation of patients, will tend to equalize the relative mortality after operations in town and country. At the Royal Free Hospital, where this principle is rigorously observed, pyæmia, for example, is of very rare occurrence.

(3) The *operation* itself, as to whether the amputation be performed for *injury* or *disease*, is followed by a very different rate of mortality, and in favour of disease. Thus, the mortality resulting from amputation in the thigh and leg, as performed in the Provincial Hospitals, differs considerably under these circumstances; being in regard to the thigh; 61 per cent., after amputation for injury, and only 23·4 per cent., after amputation for disease; and in respect to the leg; 40 per cent., as compared with 25·5. In the Parisian Hospitals, Malgaigne's statistics show less disproportionate results between the operation for injury and disease; in the thigh, 74 per cent., and 60 per cent.; in the leg, 63·3, and 49. But, after amputation of the foot; the proportionate mortality was 66·6 per cent., and 10·3 per cent.; and after the operation in the arm; 56·6, and 6·5. In University College Hospital, the results of 274 cases of amputation, in the thigh, leg and foot, shoulder and arm, and forearm, presented the following total proportion of mortality; for injury, in 92 cases, 36 deaths, or 39·1 per cent.; for disease, in 182 cases, 30 deaths, or only 16·5 per cent.

The causes of the greater relative mortality after amputation for injury, would appear to be; the greater severity of the shock, the tendency to pyæmia, the liability to tetanus, or to gangrene of the stump; whereas, exhaustion, or pneumonia, would seem to be the chief causes of a fatal result from amputation for disease. The *kind* and the *extent* of the local condition has also an unquestionable influence on the result of the operation; as illustrated by the importance of compound and comminuted fracture, and of malignant disease, in relation to their mortality after amputation. With regard to disease, a chronic state of the morbid condition, is least unfavourable for operation; as is well illustrated by the results of excision of the joints and bones.

The *period after injury* least unfavourable for amputation, has led to the distinction of primary and secondary amputations; the one being performed within the first twenty-four hours, or before the supervention of inflammation; the other, after that period, when inflammation has supervened, or at a later period, suppuration. The results of primary and secondary amputations differ in civil and military practice. In *civil* practice, the mortality from primary amputations is rather higher than from secondary amputations; but in a variable proportion according to whether it be the lower or the upper extremity, and the proximity of the operation to the trunk. In the lower extremity, and particularly in the thigh, primary amputation is most fatal. Of 46 cases, recorded by Malgaigne, 34 died. Of 24 cases, recorded by South, Laurie, and Peacock, as having occurred in old St. Thomas's Hospital, the Glasgow, and Edinburgh Infirmarys, all were fatal. The mortality increases the higher the operation is towards the trunk, and especially when performed for compound fracture of the femur, instead of for injury to the knee-joint or the leg. The total results of amputations in the thigh, leg, and foot, shoulder, arm, and forearm, as performed at University College Hospital, may be thus compared. Of primary amputations; in 48 cases, there were 18 deaths; of secondary amputations; in 43 cases, 19 deaths. In *military* practice, the mortality is reversed; secondary amputations, excepting those of the hip-joint, being far more fatal than primary operations. Of 300 secondary amputations by Faure, only 30 recovered; whilst three-fourths of Larrey's primary amputations re-



covered. With regard to whether the operation be performed in the upper or the lower extremity; during the Peninsular War, the mortality after secondary amputation in the one case was twelve times, and in the other, only three times, as great as after primary amputation of these parts; a difference more adverse to secondary amputation in the upper limb. The seat of operation in the upper and lower limbs, affects the mortality, as shown by the results in the British Army during the Crimean War. Thus, the relative rate of mortality per cent., was as follows. From primary amputations—at the shoulder, 27; of the arm, 17; of the forearm, 3; of the thigh, 62; of the leg, 30; and of the foot, 17. Then again, from secondary amputations, the death-rate per cent., in different parts, was; at the shoulder, 66; of the arm, 31; of the forearm, 28; of the thigh, 80; and of the leg, 76.

The cause of death, as well as the rate of mortality, differs after *primary* and *secondary* amputations. The former are more often fatal from shock, hæmorrhage, exhaustion, and perhaps tetanus, or pyæmia; the latter period of operation is especially prone to a fatal issue from exhaustion, tetanus, pyæmia, erysipelas, pneumonia, or other visceral affections, and to gangrene of the stump. But statistical results are wanting to accurately determine the relative frequency of these causes of death, as to the period of amputation, and their comparative frequency.

The *seat* of amputation, in relation to the mortality of this operation, has already been alluded to. The danger and the death rate are greater in proportion to the proximity of amputation to the trunk; and in an increasingly ascending ratio, the higher the line of operation, and the larger the size of the part amputated. Common surgical experience shows that the removal of a toe or finger is less hazardous than amputation of the thigh or arm. But statistical results have shown the regularly ascending mortality according to the line of amputation. Thus, in the American War, the percentage of mortality rose as follows:—fingers and hands, 1·5; wrist, 5·5; forearm, 16·5; arm, 21; shoulder, 39; partial of foot, 9; ankle-joint, 13; leg, 26; knee, 55; thigh, 64; and hip, 85. Some relation subsists between the proximity to the trunk and the causes of death, from amputation. Thus, the removal of a limb high up, is more fatal from shock, or hæmorrhage, primary or secondary.

The *structure* of the bone sawn through, when the medullary canal is opened, seems to have some degree of unfavourable or even fatal influence; owing to the liability of consecutive suppurative inflammation of the medullary membrane,—osteomyelitis, and pyæmia. But the importance of this condition relatively to the mortality after amputation, is very undetermined.

#### PARTICULAR AMPUTATIONS.

AMPUTATIONS OF THE UPPER EXTREMITY.—THE HAND.—*The Fingers; at their Phalangeal Articulations*, not unfrequently require amputation; for injury, or disease, as caries resulting from whitlow. This operation is very simple. The hand being held prone, and the fingers on either side of the affected one drawn towards the palm by an assistant; the operator lays hold of the end of the finger, and bending it slightly, he applies a narrow-bladed bistoury or scalpel to one side of the joint, opposite the articulation (Fig. 279), and carrying it over to the opposite side, makes a slightly convex incision, directed downwards; then, running

the knife across and through the joint, bending it as needs be, the blade is turned flat under the phalanx, and the semilunar flap made of sufficient length to cover the extremity of the bone and unite with the dorsal incision. *Another and reverse mode* of doing this operation is; by placing the hand in the supine position, and with the finger extended, to transfix on the palmar aspect of the joint, and carrying the blade flat on the bone, cut a semilunar flap of sufficient length; then, passing the knife across and through the joint, to divide the skin almost transversely in bringing it to the surface.

FIG. 279.



*Amputation through any of the Phalanges*, may be performed in like manner.

*Amputation of the entire Finger, at the Metacarpo-phalangeal Articulation.*—Having placed the hand in the prone position with the fingers, on either side of the affected one, drawn towards the palm by an assistant ;

FIG. 280.



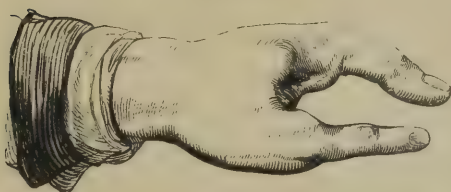
FIG. 281.



the point of a long narrow bistoury or scalpel is entered on the dorsal aspect of the metacarpal bone about half an inch above the head of this bone or knuckle, and carrying the incision forward to the interdigital web, and round the palmar aspect of the finger, the knife is turned obliquely backwards along the interdigital web of this side also, to join

the dorsal incision. A kind of looped incision is thus formed, embracing the root of the finger from above the joint and there including an angular portion of integument. The oval flap is easily drawn back, the extensor tendon divided across, and the finger disarticulated. (Fig. 280.) The bulky head of the metacarpal bone had better then be removed with bone-forceps, introduced from the dorsal surface, and by nipping the bone cleanly across (Fig. 281); unless it be the index or little finger, in regard to both of which the bone should be nipped across obliquely from without inwards so as to conform to the outline of the hand. After tying or twisting the digital arteries, the edges of the incision readily fall together into a line, and the fingers being brought together, the gap is scarcely perceptible. A palmar splint is applied, and simple dressing as usual. The *Metacarpal bone* may be included by carrying the incision further back; but it is better to leave the base of the bone,—not to open the wrist-joint, and care should be taken not to wound the palmar arch in removing the bone from its bed.

FIG. 282.



Several Fingers, with perhaps their metacarpal bones, requiring removal for disease or injury; the operation can be fashioned in a similar manner, leaving a very useful forceps-hand. (Fig. 282.)

*Amputation of the Thumb, at its Carpo-metacarpal Articulation,* is the only amputation peculiar to the thumb.

Commencing an incision just above the articulation of the base of the metacarpal bone with the trapezium, and continuing it down the dorsal aspect of the bone, inclining slightly to the radial side, the knife is sunk into the fold of integument between the thumb and forefinger (Fig. 283); then introducing the knife at this extremity of the incision, and thrusting it up along the palmar aspect of the bone, its point is made to emerge at the commencement of the incision, and the palmar integument divided outwards. The bone is twisted out, and disarticulated with a few touches of the knife, the lips of the oval wound form a single incision, and eventually a linear cicatrix. By this, or Liston's method of amputation, there is a *single* line of incision. In operating on the right thumb, it will be necessary for the Surgeon to cross his hands, in an awkward manner; unless he is ambidextrous. *Another method* consists in carrying the dorsal incision downwards to within half an inch of the metacarpo-phalangeal articulation, and then in an oval form around the joint, up to the dorsal incision. When the flap is brought together, there will still be only a single line of *cicatrix*.

FIG. 283.





*Amputation of the Little Finger, at its Carpo-metacarpal Articulation, may be performed in a similar manner.*

**AMPUTATION AT THE WRIST-JOINT.**—The radio-carpal articulation is as easily opened as any of the joints in the hand. An assistant holding the forearm, the operator lays hold of the hand on its palmar aspect, with his forefinger and thumb on the styloid processes of the radius and ulna; thus spanning the wrist, as the limits of the incision. A short narrow-bladed amputating-knife is used instead of a bistoury, and an incision made from one styloid process to the other, across the back of the joint, slightly curving towards the hand. (Fig. 284.) Passing the knife across the joint, clear of the arched-shaped surface of the carpal bones, the lateral ligaments are divided, and the knife carried forward on the palmar surface of the metacarpal bones, so as to make a rounded flap of sufficient length to cover the ends of the radius and ulna, and unite with the dorsal incision. In turning the knife round the joint, care must be taken not to hitch against the pisiform bone, which projects forward, on the palmar aspect, beyond the other bones of the carpus. The radial and ulnar arteries will require ligature or torsion, and perhaps some interosseous carpal branch.

FIG. 284.



An *artificial hand* may eventually be adapted to the stump; one of the most useful forms is here represented (Fig. 285), and one of its most important uses. (Fig. 286.)

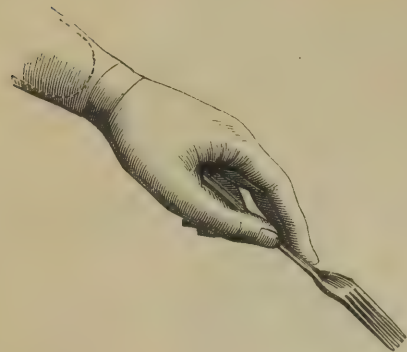
FIG. 285.



**AMPUTATION OF THE FOREARM.**—The middle of the forearm is the part to be preferred for amputation, as affording the most convenient coverings to the stump, and a tolerably suitable length of stump for the application of an artificial hand. The brachial artery must be commanded by an assistant, and the forearm held by another assistant, in a state of extension and semi-pronation,—the radius looking upwards. The margins of the bones should be felt by the operator with one hand; a posterior flap is then made by a curved incision downwards; commencing on the palmar margin of the radius, on the left side, and continued a little way

down along the bone, arching across the back of the forearm, and up along the ulna to a point on its palmar aspect opposite to the other horn of the incision, it thus extends forward sufficiently on either side for easy transfixion in front of the bones. (Fig. 287.) This flap is reflected by

FIG. 286.

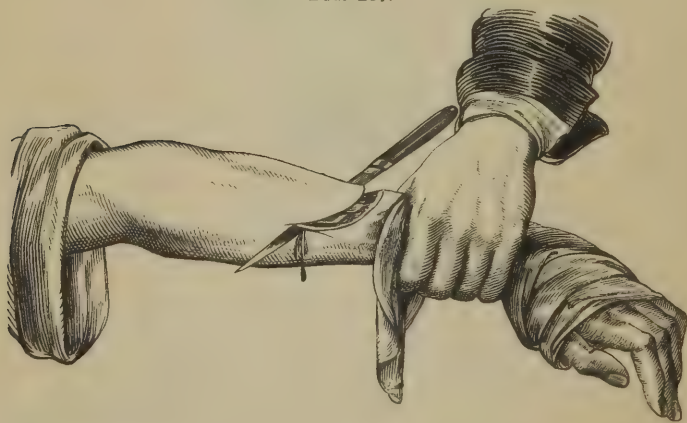


a stroke or two with the knife; and the point being entered at one horn of the incision, in front of the bones, and made to emerge at the other, an interior flap of corresponding shape and length, is formed by carrying the knife from within outwards, along the surface of the bones. Both flaps are retracted by an assistant. Sweeping the knife around the bones to divide any remaining muscular fibres and cutting across the interosseous membrane with the point of the instrument; the bones are then sawn together. The radial,

ulnar, and interosseous arteries in the anterior flap, must be ligatured or twisted, and the flaps adjusted with sutures.

This method of performing amputation of the forearm, provides for

FIG. 287.



easy transfixion, and is the most dexterous; but in a similar position of the forearm,—semi-pronation, both flaps may be made by transfixion.

*An artificial forearm* may be fitted thus (Fig. 288). It is a modification by Mr. Bigg, of Beaufort's arm. The hand may be adapted for a variety of important movements—as in writing or driving.

**AMPUTATION OF THE ARM.**—An assistant compressing the brachial artery, the Surgeon makes a couple of equal flaps, an anterior and a posterior, simply by transfixing the arm in front of the humerus, and cutting a well-rounded flap, and then entering the knife behind the bone and making another such flap. (Fig. 289.) These are retracted by an assis-

tant. A sweep of the knife clears the bone, which is then sawn through; care having been taken that the musculo-spiral nerve was divided by the knife at the back of the bone—if the amputation be at that part of the arm where this nerve winds round behind the humerus. The artery, and any bleeding branches of magnitude, are secured, and the flaps brought together.

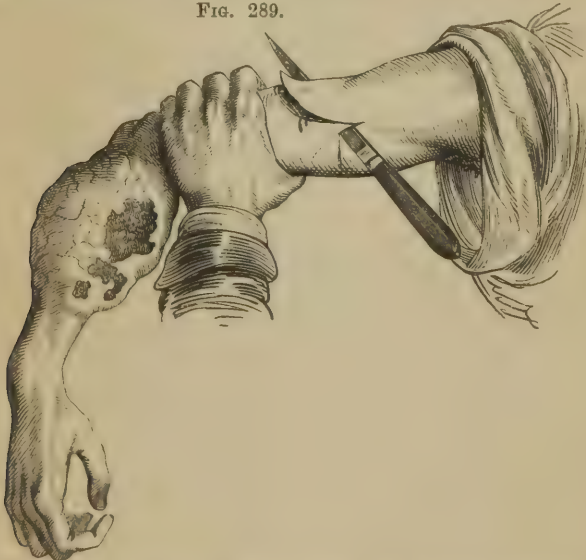
Circular amputation, as in the thigh, will be preferable, if the limb be very fleshy.

*Results.*—Amputations of the forearm, or of the arm, are very successful. For disease, as of the joints or bones, amputation is especially successful; but far less so for malignant disease. For injury, the operation in either part is more fatal; the death-rate per cent. rising, as usual, relatively to the amputation nearest the trunk. Thus, during the American War, the proportion was, after amputation of the forearm, 16·5; the arm, 21. In the Crimea, amputations of the forearm were fatal in the ratio of only 7, and those of the arm 19, per cent. At University College, in Mr. Liston's and Mr. Erichsen's practice; in 8 traumatic amputations of the forearm, all recovered; whereas, of 11 such amputations of the arm, there were four deaths. At Guy's Hospital, according to Mr. Byrant's statistical results, the ratio of fatal traumatic

FIG. 288.



FIG. 289.



amputations of the forearm and arm, was, 16, and 22, per cent.; thus almost exactly equalling the proportionate mortality during the American War. And this comparative result was in *Civil* and *Military* practice, respectively.



An *artificial arm* may be adapted to the stump; and of the various

FIG. 290.

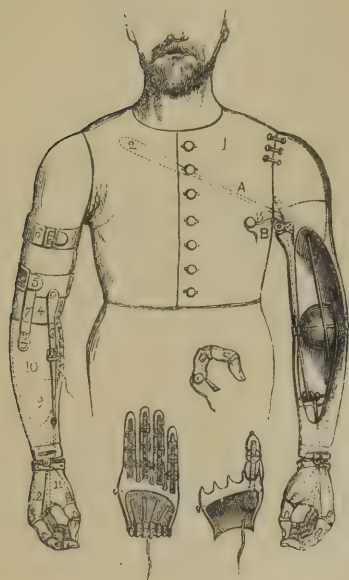


FIG. 291.

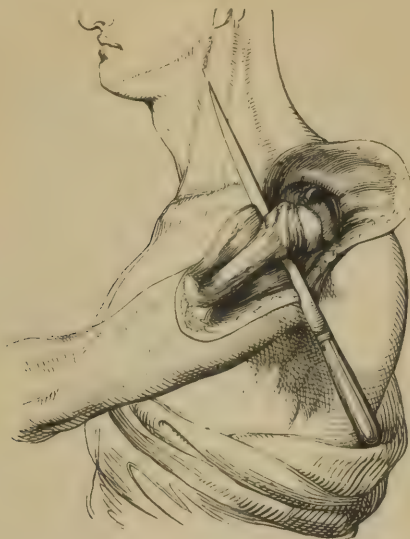


forms invented, the best construction is Van Petersen's, if the stump be long and mobile (Fig. 290); or the less costly arm invented by Count de Beaufort (Fig. 291).

**AMPUTATION AT THE SHOULDER-JOINT.**—An assistant standing above the shoulder, compresses the subclavian artery as it passes over the first rib; or if he know the operation practically, he may be trusted to catch the artery with his thumbs in the inner flap. Another assistant holds the arm up so as to relax the deltoid muscle. The Surgeon—operating on the *left* arm—introduces a long-bladed amputating-knife at the posterior border of the axilla, and passing it in front of the joint, makes it emerge at the anterior border of the deltoid muscle, about an inch below the point of the acromion; cutting downwards and outwards, a large flap is formed chiefly of the deltoid muscle and skin. This flap is raised by an assistant at the shoulder, and the arm brought down towards the front of the chest; thus presenting the head of the humerus and muscles attached to the tuberosity. Running the knife across the joint, these are divided, with the capsular ligament, and the knife turned to the inner side of the joint (Fig. 292), followed by the hand of another assistant ready to compress the artery. The arm is again raised to give freedom in making the flap, and the knife carried downwards close to the bone, forming an inner flap corresponding to the outer one; while at this moment, the assistant in charge grasps the whole thickness of the inner flap with both hands, between his fingers and thumbs crosswise, and catches the artery as it is divided. If this be done dexterously very little blood escapes. Amputation at the *right* shoulder-joint is performed in precisely the same way, only that the shoulder is transfixed from before backwards, the knife being entered in front of the deltoid about an inch below the acromion, and made to emerge at the posterior border of the axilla. The axillary

artery and other vessels having been tied or securely twisted, the flaps are adjusted with sutures.

FIG. 292.



*Results.* — Amputation at the shoulder-joint, for disease of the humerus, is more successful than the same operation for injury, the mortality, in the latter case, amounting to 35 during the Crimean War. The death-rate per cent. in the American War was 39; that after amputation in the arm being only 21 per cent., a difference of 18 adverse to amputation at the shoulder-joint. The injury requiring amputation, as compound fracture of the humerus high up, is usually accompanied with other injuries, particularly of the head, thus increasing the risk of a fatal result.

#### AMPUTATIONS OF THE LOWER EXTREMITY.

**THE FOOT.**—*Amputations of the Toes, at their Phalangeal Articulations, and at their Metatarso-phalangeal Articulations.*—These operations are performed in a manner precisely similar to the analogous operations on the Fingers. In amputations at the last-named articulations, the incision must be commenced proportionately farther back than in the Hand, these articulations being situated at some distance above the web of the Toes (Fig. 293); and it is undesirable to remove the head of the metatarsal bone, which would diminish the breadth and support of the foot.

*Amputation of the Great Toe, at its Tarso-metatarsal Articulation.*—With a stout bistoury, commence an incision on the dorsum of the foot, at the posterior extremity of the interspace between the metatarsal bones of the first and second toes; carry the incision forward to the ball of the great toe, and curve it inwards upon the ball to the sole of the foot, at a part opposite to the web between the toes; thence draw the knife backwards along the sole of the foot, parallel with the outer margin of the metatarsal bone of the great toe to a point opposite to the commencement of the dorsal incision. Dissect the flap back, close to the bone; divide

the web between the first two toes, avoiding the sesamoid bone here situated, and isolate the metatarsal bone; then twisting the great toe inwards, pass the knife deeply into the angle of the wound and open the

FIG. 293.



FIG. 294.



articulation with the internal cuneiform bone, detaching its ligamentous connexions; and thus complete the amputation. (Fig. 294.)

The *metatarsal bone alone* can be removed by the first part of this operation; the flap being made without then dividing the web of the toes.

*Amputation of the Little Toe, at the Tarso-metatarsal Articulation.*—This operation is analogous to that for the removal of the Great Toe; but the line of incision is here *single*. The knife is entered just behind the prominent tubercle of the metatarsal bone of the little toe, and carried inwards and forwards in the oblique line of its articulation with the cuboid; thence into the fourth metatarsal interspace forward to the web of the toe, and around under the toe, back into the incision on the dorsum of the foot. The integument is dissected off, exposing the metatarsal bone, the bone isolated; and, the toe being forcibly drawn outwards, the joint is opened in the angle of the wound, and the operation completed.

*Amputation of the whole of the Toes, at their Tarso-metatarsal Articulations.*—*Hey's Operation.*—This amputation is performed by a dorsal incision, slightly curved downwards, and a plantar flap, the limits of which transversely are the tubercle of the metatarsal bone of the little toe and the base of the first or the tubercle of the scaphoid bone in preference; the flap extending forward sufficiently to cover the ends of the tarsal after disarticulation of the metatarsal bones. The leg is placed with the foot downwards, and steadied by an assistant; the Surgeon grasping the fore-part of the foot and feeling with his finger and thumb the points of bone above mentioned, he makes a semilunar incision from



the one to the other across the back of the foot, cutting down to the bone and reflecting this short flap of integument. (Fig. 295.) Passing the



FIG. 295.

knife under the bases of the metatarsal bones from one horn of the incision to the other, and transfixing the foot, a longer flap is made from the sole of the foot. (Fig. 296.) The irregular line of articulations is then

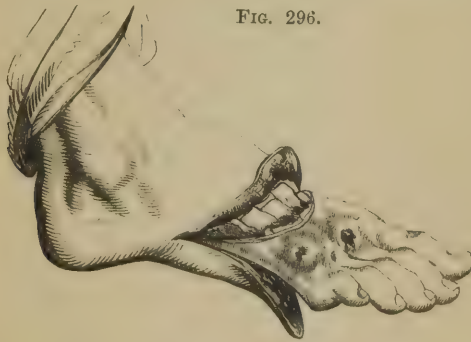


FIG. 296.

opened with the point of the knife, while the fore-part of the foot should be forcibly depressed to facilitate disarticulation. The plantar flap is adjusted with sutures, and a single cicatrix remains on the dorsal aspect of the stump. (Fig. 297.)

FIG. 297.

*Amputation through the Tarsus*,—in the line of articulation between the astragalus and os calcis, posteriorly, and the scaphoid and cuboid bones, anteriorly.—*Chopart's Operation*.—The guides to this operation are; the tubercle of the scaphoid bone on the inner side of the foot, and a point about half an inch behind the tubercle of the fifth metatarsal bone on the outer side of the foot, or about midway between this projection and the front of the outer malleolus. The



operation is similar to Hey's, only that the incisions are commenced further back (Fig. 298); the dorsal curved incision is made between the points

FIG. 298.



of bone above named; the tarsal bones must then be disarticulated; and the plantar flap formed, keeping the knife well turned towards the under,

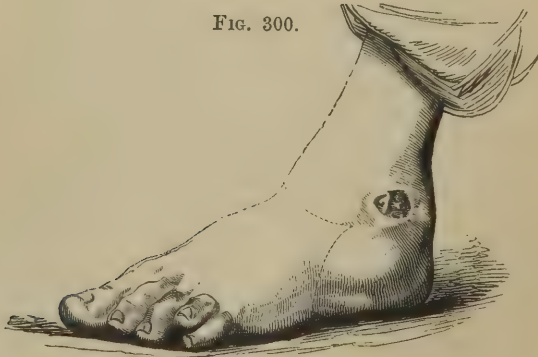
FIG. 299.



concave surface of the metatarsal bones, and extending this flap, forwards to the root of the toes, where it should be rounded off across the sole of the foot. The vessels are thus left uninjured, and an ample cushion formed. The head of the astragalus had better be sawn off; and the tendo-Achillis, which is apt to tilt this bone forward, may be divided by subcutaneous section at the time of the operation, or subsequently. The stump, as compared with that made by Hey's amputation, is here represented. (Fig. 299.)

**AMPUTATION AT THE ANKLE-JOINT.—Syme's Operation.**—This amputation consists in making a posterior heel-flap, and an anterior incision across the joint; disarticulating the foot, and taking a slice off the end of the tibia. The foot projecting over the end of a table, and at a right angle to the leg; a stout bistoury is entered at the centre of one malleolus, and drawn downwards and slightly

FIG. 300.



backwards, under the prominence of the heel, upwards and forwards to a corresponding point at the other malleolus. Or, the heel-incision may be carried slightly forwards. (Fig. 300.) The flap, marked out

by this incision, is dissected back to the tendo-Achillis; the operator placing his fingers upon the heel, while his thumb rests upon the edge of the flap, he cuts between the nail of the thumb and the tuberosity of the os calcis, pressing back steadily at the same time. In reflecting the integument round the tuberosity, the risk of making a button-hole will thus be avoided; and by still keeping the knife close to the bone on the inner side of the os calcis, the plantar arteries are not injured. An incision is next made from one upper extremity of the heel-flap, across the dorsum of the foot to the other extremity; then, depressing the foot, the joint is opened and the lateral ligaments divided by the point of the knife; the astragalus is disarticulated, and the tendo-Achillis divided, as also any slight connexion of the os calcis, and the foot removed. A thin slice is sawn off the end of the tibia, including the two malleoli. The plantar arteries are secured, and the heel-flap is brought forward to the anterior incision and retained by sutures. An excellent stump often results, with only a transverse line of cicatrix. (Fig. 301.)

FIG. 301.



Professor Pirrie makes a slight modification of this amputation, by sawing off the ends of the bones, *without* previous disarticulation of the foot; thereby shortening the operation.

*Pirogoff's operation* is a modification of Syme's. It consists in preserving the posterior portion of the os calcis, which is retained in the heel-flap. This flap is reflected back about two lines; the anterior incision is made, the astragalus disarticulated, and the malleoli sawn off with a thin slice of the tibia; then, the saw is entered behind the astragalus on the upper and back part of the os calcis, which is sawn obliquely downwards and forwards. The posterior portion of the calcaneum, thus left, is brought up into contact with the tibia; leaving the tendo-Achillis undivided, and forming a longer stump for support. The osseous surfaces readily unite.

The chief advantages of this operation are; the increased length of stump, and the less liability to sloughing of the heel-flap,—the plantar arteries always being cut long and the general vascular communications remaining undisturbed. The disadvantages are; the greater liability to osteo-phlebitis, owing to the section of two osseous surfaces; and the recurrence of disease in the portion of calcaneum left in the heel-flap. This latter objection, however, does not apply to the amputation when performed for injury.

Professor Pirrie has devised a simplification of this operation also, and one which includes his modification of Syme's amputation. The os calcis is sawn from *below*,—upwards and backwards; and then—having made the anterior incision—the tibia and fibula are sawn through just above the malleoli, without previous disarticulation of the foot.

*Sub-astragaloid Amputation*.—Removal of the foot below the astragalus is analogous to Syme's amputation; that bone being left and the operation performed between it and the calcaneum, at the articulation of these bones. A heel-flap having been made as in Syme's amputation;



an anterior incision lays open the articulation between the astragalus and scaphoid bone, as in Chopart's amputation; the knife is then passed backward between the astragalus and calcaneum, dividing their interosseous and other ligamentous connexions, and the foot is removed. A longer, and so far more useful stump remains than after Syme's amputation at the ankle-joint; but sub-astragaloid amputation is comparatively rarely eligible,—only when the astragalus is not involved.

*Hancock's Operation*—consists in amputation of the foot below the astragalus, leaving the posterior third of the os calcis, which is turned up against the under surface of the astragalus, prepared for its adaptation and union therewith by also removing the under surface and head of this bone. This operation, therefore, bears the same relation to sub-astragaloid amputation, that Pirogoff's operation does to Syme's amputation at the ankle-joint. As an improvement on sub-astragaloid amputation, Hancock's amputation provides a more advantageous stump, in two essential points; namely, the length of the limb, and the amount of leverage afforded by the astragalus for the artificial foot, and the consequent effects upon the movements of the ankle-joint. This operation would seem to be suitable for disease or injury involving the tarsal bones, excepting the astragalus, and when limited to the anterior portion of the os calcis. It was originally performed by Mr. Hancock in the winter of 1864-5, and in the only case so far as I know in this or any other country; the case was one of scrofulous disease, which presented the requisite conditions for this amputation. The result was perfectly successful; complete union taking place between the section of the os calcis and astragalus, and the patient having a most useful stump. He was exhibited at the Royal College of Surgeons, in June 1866, one year and a half after the operation; when, among many other observers, I had the opportunity of examining the permanency of this result.

The particulars, therefore, of the original operation possess some historical interest; and as illustrating the plan and performance of an amputation not hitherto described in Surgical works, I shall here introduce Mr. Hancock's description :—"I commenced an incision beneath and at the posterior angle of the external malleolus, and carried it forwards along the outer border of the foot to a point about half an inch anterior to the projecting base of the fifth metatarsal bone. I then made a second incision along the inner border of the foot, commencing posteriorly about the centre and beneath the internal malleolus, and terminating anteriorly at a spot corresponding to the termination of the external incision; and then united the two by a third and semilunar incision, carried, with its convexity directed towards the toes, across the front of the sole of the foot well down to the bones. Reflecting this flap back as far as the projections on the under surface, and in front of the tuberosity of the os calcis, I carried a fourth incision across the dorsum of the foot, immediately behind the head of the astragalus. Then, applying a saw upon the under surface of the os calcis as far back as I could, I cut through the bone obliquely from below upwards and backwards. Next, resuming the knife, I entered the medio-tarsal articulation, and, passing the instrument under the head of the astragalus, and cutting from before backwards, in the direction of the anterior articulating surface on the os calcis, divided the interosseous ligament, and detached the front of the foot. I then sawed off the head of the astragalus, and with a pair of bone-cutters, curved on the flat, removed the two articular cartilages on the under

surface of this bone, and securing the two plantar arteries, thus completed the operation. The flaps were brought together by three wire-sutures in front, the lower angles of the wound being left open. No suppuration ensued in the course of the tendons, no secondary hæmorrhage, nor any constitutional disturbance."

*Results of Tarsal and Ankle-joint Amputations; see EXCISIONS.*

After any of these amputations, at, or immediately below, the ankle-joint, an *artificial-foot* may be adapted. A common, and cheap form, is a

FIG. 302.



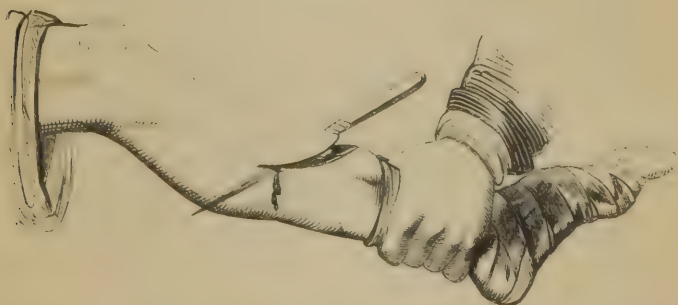
FIG. 303.



leathern-hood, not unlike an elephant's foot (Fig. 302); or Bigg's artificial foot will be a complete apparatus. (Fig. 303.)

**AMPUTATION OF THE LEG.**—An assistant commands the femoral artery by digital pressure or compression with a tourniquet, and the leg projecting beyond the edge of a table, should be held horizontally by another assistant seated on a low chair or stool. The Surgeon standing as usual so as to grasp the limb below the seat of amputation, enters the point of

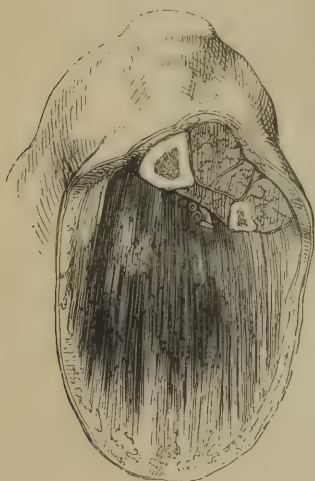
FIG. 304.



the knife at the posterior edge of the tibia—on the left leg, carries it downwards on the bone for about an inch and a half, curves the incision across the anterior aspect of the leg to the posterior margin of the fibula, and up that bone to the point opposite its commencement on the tibial side. (Fig. 304.) The flap is reflected by a few touches with the point

of the knife, which is then made to transfix the limb behind the bones from one horn of the anterior flap to the other—care being taken not to lock the instrument between the bones—and by cutting obliquely downwards and backwards, a long posterior flap is formed. The interosseous membrane is divided transversely, with the point of the knife, and a sweep round the bones clears a line for the saw. In

FIG. 305.



applying the saw, the fibula should be divided first; otherwise, as a slender long bone, it will be splintered; and the tibia had better be sawn obliquely from before backwards, to make the anterior flap lay more easily than it would on the sharp ridge of a transverse section of the bone. Any projecting spiculous portion of bone must be clipped off with cutting-pliers. The arteries requiring ligature or torsion, vary with the situation of the amputation; in the middle third of the leg, the anterior and posterior tibials between the bones of the stump must be tied; in the upper third just below the knee, the popliteal trunk may not have bifurcated, and one artery alone may have to be ligatured. (Fig. 305.)

Another mode of performing this amputation is; by transfixion and the formation of a posterior flap first, and then the anterior semilunar flap.

The stump, in either case, is apt to bag and drop, owing to the bulk and weight of the posterior flap; which is not less than three inches in length, and bulky in proportion to the muscular development of the calf.

*Teale's amputation*, by a long anterior and a short posterior rectangular flap. This operation obviates the difficulty last referred to; but its comparative merits in other respects, as a mode of amputation, have been already considered.

*Artificial legs* are here represented; the common form, a wooden or "box-leg" (Fig. 306), the more complete leg (Fig. 307).

*Results.*—Amputation of the leg, is, on the whole, a successful operation; but, like other amputations, the mortality differs according to whether the operation be performed for disease or injury, and the nature, and the situation of either. For disease, the average death-rate per cent., is 25.5; whilst, for injury, it rises to 26, as in the American War; 37, as in the Crimea; or even 40 per cent., as in the London and Provincial Hospitals during a period of three years. Primary amputation, is generally more fatal than secondary; but, Mr. Bryant's statistics of cases in Guy's Hospital, seem to reverse this rule; at the one period of operation the mortality being 62 per cent., and at the other or secondary period, amounting to 66 per cent. Proximity to the knee-joint, increases the risk of amputation.

**AMPUTATION AT THE KNEE-JOINT.**—Two methods of performing this operation are occasionally practised; by a short anterior and long posterior flap, or by a long anterior and short posterior flap.



Operation by a *short anterior and long posterior flap*.—A transverse or slightly curved incision is made across the knee-joint, above the patella,

FIG. 306.



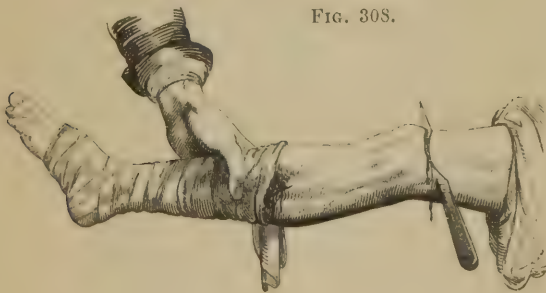
FIG. 307.



from condyle to condyle of the femur; the extensor tendon, lateral ligaments, and crucial ligaments, are successively divided, and the joint fairly opened; the knife is inserted behind the tibia, a

long posterior flap cut downwards and backwards from the upper part of the calf of the leg, and the leg removed. (Fig. 308.) The articular sur-

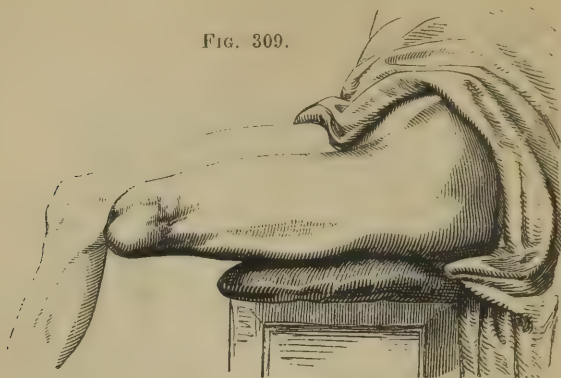
FIG. 308.



face of the femur is then sawn off, the popliteal artery tied or twisted securely, and the flaps brought together with sutures. The stump made by this amputation, may be most excellent, and as a permanent result. It was so in a case, after this mode of operation, by Sir W. Fergusson, in 1845. Since that time, the man has repeatedly walked forty miles a day, with a very indifferently made artificial leg; and on one occasion, a

hundred and twenty miles in three days, without the slightest damage to the stump. (Fig. 309.)

FIG. 309.



Operation by a *long anterior and short posterior flap*.—An incision is made from one condyle to the other, extending below the patella; the ligamentum patellæ must then be divided, and the flap of integument, including the patella, reflected; the lateral and crucial ligaments having been divided, the knife is passed behind the tibia, and a short abrupt flap cut outwards. The operation is then completed as before. The patella had better be left, for protection of the stump; but the cartilaginous surface of the condyles may be advantageously sawn off.

SUPRA-CONDYLOID Amputation may be performed in like manner as the operation at the Knee-joint.

The advantages of both these amputations,—through, or just above the knee joint, as compared with removal of the limb higher up, are three. They relate to the results of operation,—both in regard to mortality, and the kind of stump.

*Results.*—Of 49 cases of amputation through the knee-joint, collected by Dr. Markoe, 17 were fatal; being a mortality of 37 per cent., or about half the percentage, 64, of amputation in the thigh, during the American War. But in that War, the death-rate was 55 per cent. after amputation at the knee-joint. The results of supra-condyloid amputation have not yet been indicated by statistics, in relation to its mortality. But, like the operation through the joint, it may fairly be inferred that this operation also is far less fatal than amputation in the thigh; the medullary canal of the femur not being opened in the two former amputations. The results with regard to the *stump* are certainly very advantageous; a long stump is provided for the adaptation, and more convenient use, of an artificial limb; and, after the operation with a long anterior flap, the end of the stump is well covered by integument, and thus protected from the risk of excoriation from pressure, as the cicatrix lies altogether behind the surface.

AMPUTATION OF THE THIGH.—An assistant compresses the femoral artery, and another sitting on a stool, holds the leg so that the thigh shall be horizontal, and project from the buttock over the edge of a table. The Surgeon with his left hand lays hold of the fleshy part of the thigh in front of the bone and raises it a little, then introducing a long-bladed

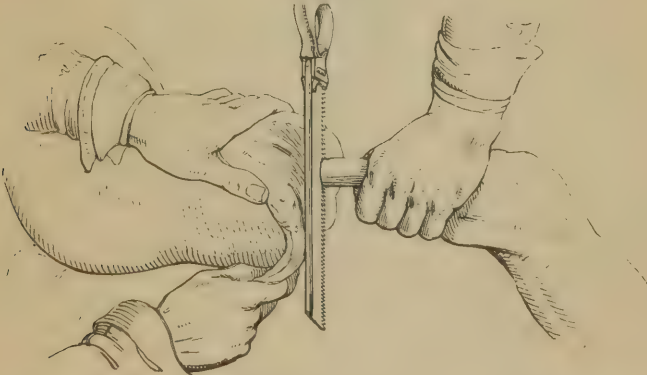
amputating knife just in front of the femur and transfixing the thigh, an anterior flap is made by cutting downwards and outwards to the surface. (Fig. 310.) Entering the knife again, about an inch lower than the upper

FIG. 310.



limit of the former incision, and passing it behind the bone to the same point on the other side of the thigh, a posterior flap is made of corresponding length and shape. The advantage of re-entering the knife as directed, is not to jag the integument by the alteration of level necessary

FIG. 311.



to transfix the thigh, in lowering it under the bone. Both flaps should be now retracted by an assistant, the knife swept round the bone at the highest point, and the bone sawn transversely across by a light vertical action of the saw. (Fig. 311.) The leg-assistant must observe to evenly



support the limb, as the bone is divided; not to lock the saw by elevating the limb, nor to snap and splinter the bone by allowing the limb to drop. The artery and any muscular branches must then be seized with artery-forceps (Fig. 312), and secured by ligature; or by acupressure, or torsion; and the flaps evenly adjusted with sutures.

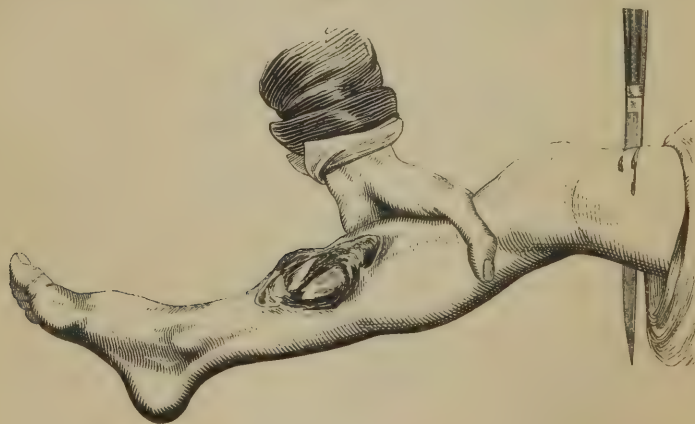
FIG. 312.



The *circular method* of amputation may be preferred, especially in a very muscular thigh (see p. 682).

*Amputation of the Thigh, by Lateral Flaps,—Vermale's operation.*—In the lower third of the thigh, amputation is best performed by lateral,—instead of antero-posterior flaps; the sides of the thigh, in this part, being more fleshy, and better fitted for the formation of a stump. The surgeon grasping the soft parts, on the outer side of the thigh, with his

FIG. 313.



left hand, and drawing them outwards from the side of the femur; the knife is entered perpendicularly in the middle of the thigh, about three inches above the upper border of the patella, and thrust downwards close round the bone, and brought out in the centre of the ham (Fig. 313);

the flap then being cut downwards and outwards. The knife is again entered, at the upper angle of the incision, the thigh transfixed close to the side of the bone, and the point being brought out at the lower angle of the incision, a corresponding inner flap is made in like manner. Unless the blade be passed around the bone on this aspect of the thigh, the femoral artery is very apt to be split. The flaps are retracted, the bone cleared by a sweep of the knife, and the saw applied about four inches above the condyles.

*Forms of Artificial Leg.*—(1) *Bucket-leg* (Fig. 314)—A, a hollow sheath or bucket, accurately conformed to the shape of the thick stump; B, the pin, for support; C, strap. This leg, as well as the one already noticed for amputation *below* the knee, is in common use, by soldiers and sailors, or others of the working classes. (2) *Bucket-leg*, with substitute *mechanism* for leg below the knee (Fig. 315)—A, bucket; B, knee-bolt;

FIG. 314.

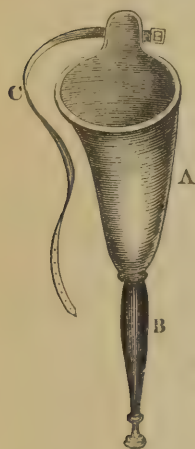
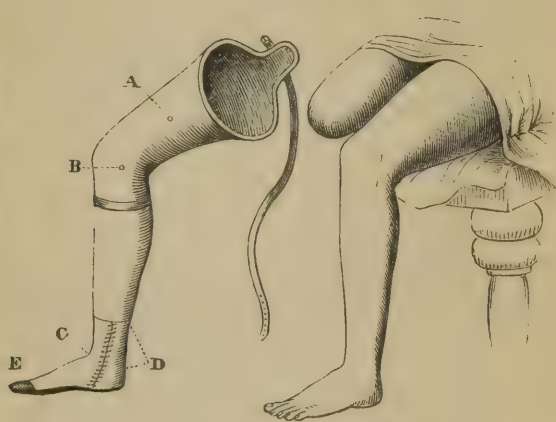


FIG. 315.



C, D, E, situation of springs, for mock muscles, governing the action of the ankle and toe-joints. (3) *Bly's leg*, of Rochester, New York (Fig. 316)—B, ball of polished ivory, for movements of ankle-joint; C, cords having the position and functions of the natural tendons; S, indicates three of the five india-rubber springs, as muscles; N, position of the nuts, for regulating tension of cords and springs; E, spring, acting on knee-joint. 2 represents ankle-joint flexed diagonally, as often occurs, when one side of the foot happens to rest on a stone or other obstacle in walking. (4) *Bigg's leg*, a modification of Bly's and Mark's legs. (Fig. 317.) This is, perhaps, the simplest, strongest, lightest, and cheapest artificial leg or limb ever constructed. A gentleman, who had for years used limbs of other construction, wrote to Mr. Bigg, saying—"I never knew what comfort was with an artificial leg, until I adopted yours; it enabled me to walk to the Boat Race, and stand six hours about upon it."

Other forms of artificial leg are, the old Anglesea leg, as used by the Marquis of Anglesea, after the battle of Waterloo; the Palmer leg; and Mark's leg, an American invention.

*Results.*—Amputation of the thigh is more fatal than any such operation, except that at the Hip-joint. In the American War, the percentage

FIG. 316.

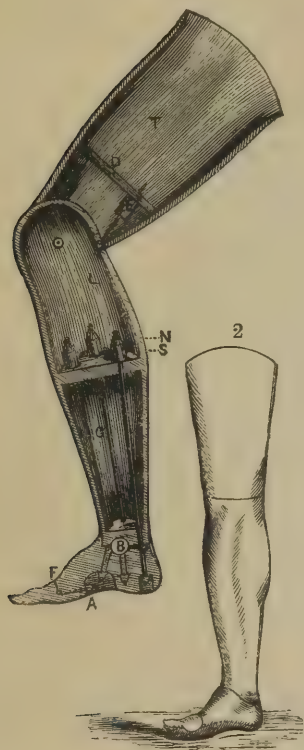


FIG. 317.



of mortality was 64, after amputation for injury. But the period of the operation, as primary or secondary, makes some difference in the mortality, and in favour of primary amputation, unless when performed for compound fracture of the femur, instead of for injury to the knee-joint or the leg. For disease, amputation of the

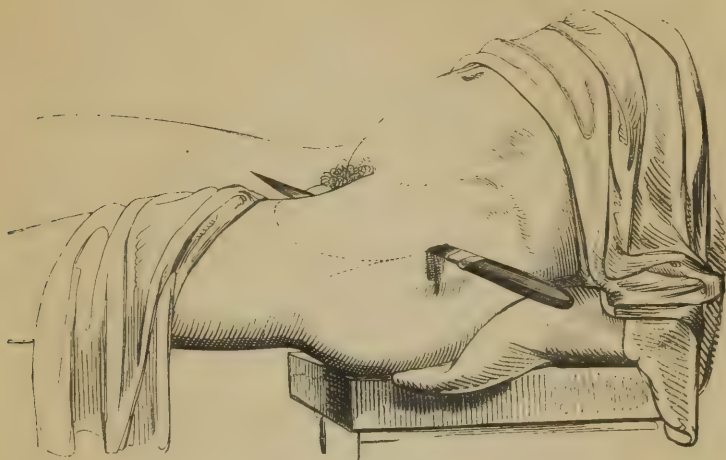
thigh is less fatal, except for acute disease of the knee-joint.

**AMPUTATION AT THE HIP-JOINT.**—This operation, so fatal in its results, is less formidable in its performance. The patient lying with his buttock on the edge of the table, an assistant supports and governs the limb; another assistant, standing at the pelvis on the side of operation, compresses the artery above the brim of the pelvis, and is ready to take charge of the vessel when divided in the first incision. Or, the risk of hæmorrhage may be guarded against, by means of Lister's compressor of the abdominal aorta. The Surgeon, standing as usual with his left hand towards the distal part of the limb, selects the longest-bladed amputating-knife; introducing it—in the *left* limb—about midway between the anterior superior spinous process of the ilium and the great trochanter, he thrusts it directly across the joint, so that its point shall emerge just above the tuberosity of the ischium (Fig. 318), the scrotum being drawn away and protected by an assistant. The knife, thus transfixing the root of the thigh, is carried rapidly downwards and forwards to the surface, cutting an anterior and inner flap, about five or six inches in length, and the breadth of the thigh. The assistant, at the pelvis, closing his hands into



the wound from either side, catches the femoral artery in the under-surface of this flap, between his fingers beneath and thumbs over the flap.

FIG. 318.



The limb should now be forcibly abducted and everted by the leg-assistant; the capsule opened from the inner side by drawing the knife firmly across, when, with a touch on the round ligament, the assistant depressing the limb, the bone starts from its socket. The knife is then laid on, about its middle, behind the head of the femur, the remainder of the capsule divided, and by drawing the knife downwards and backwards through the muscles, a shorter posterior flap is fashioned to meet the anterior one. The artery, and any muscular branches having been secured, and the large cavity well sponged with cold water; the two flaps are brought together with sutures, and a large compress applied. On the *right* limb, the operation is the same, only that the knife is *entered* in the reverse directions—namely, just above the tuberosity of the ischium.

This method of amputation at the hip-joint, by anterior and posterior flaps, is substantially the same as that recommended by Liston.

By the same mode of operation, also, the femur can be sawn through *below the trochanters*, in fracture of the shaft high up, or disease affecting the shaft below; thus leaving the head and neck of the bone, with ample flaps to cover. I have amputated just below the hip-joint for disease of the femur, consequent on typhoid fever, and with an excellent stump resulting.

The above-described amputation will have to be modified by various conditions of injury necessitating the operation, but which require its adaptation to the state of the integuments, as affected by the extent of contusion and the situation of wounds. The flaps must be contrived so as to meet these difficulties.

In a case of "severe compound comminuted fracture of the right femur," for which I had to perform amputation at the hip-joint, the operation was modified by the state of the integuments. The particulars of this operation were well reported, in the *British Medical Journal*, by Mr. C. S. Jeaffreson, then Senior House Surgeon to the Hospital. "On the after-

noon of March 15th, a man, aged 26, was brought to the Hospital from the Great Northern Railway. By some accident he had slipped under a railway truck, which passed over his right thigh, just above the knee-joint. The injuries he received were more difficult to describe than imagine; suffice it to say, that the greater portion of the integuments were torn from the entire limb, the muscles of the thigh reduced to a sort of pulp, and the bone splintered into many fragments. There was considerable arterial hæmorrhage, to stop which I placed a ligature round the femoral artery in Scarpa's triangle. The shock to the system, though very severe, was not so intense as one could have expected from such a frightful injury. The patient earnestly desired that his limb might be immediately removed. The margin of the wounded integuments was obliged to be taken as the line of incision, otherwise no skin could have been obtained to cover the stump, thus a kind of oval amputation was performed as follows: the knife was entered just below the middle of Poupert's ligament; it was then drawn obliquely downwards and inwards, crossing the back of the thigh, and prolonged upwards and inwards to the point of its departure; in this way an oval flap was made from the integuments of the back of the thigh and buttock. The muscles were then divided, the femoral artery secured, and the head of the femur turned out of the socket. Although little hæmorrhage resulted from the operation, the patient towards its end showed symptoms of severe collapse. On being placed in bed, he recovered from chloroform, but expired within three hours of the operation. This case, though of no special interest, illustrates very well one point in connexion with the practice of amputation after severe injuries—*i.e.*, that the Surgeon must not always expect to be able to follow any one particular operation as laid down in books, but in many cases must exercise his own ingenuity in the manufacture of a stump from what may be aptly called the wreck of the injured limb."

*Results.*—Amputation at the hip-joint is an operation of fatal result in the great majority of cases; in 126 cases, 76 died. But the mortality differs considerably according to whether the operation be performed for disease or injury. Thus, in 42 hip-joint amputations for chronic disease of the femur, 18 died; whereas, in 47 for injury, 35 were fatal; and the death-rate percentage was 85 during the American War. Primary amputation for injury is the most fatal; in 30 cases, collected by Legouest, all died; and in another 12, during the Crimean War, all died. In the American War, however, of 19 cases, 2 recovered. Secondary amputation for severe injury to the femur has been singularly successful; of 9 cases in America, 2 recovered; and in 4 cases, by J. Roux during the French Campaign of 1859 in Italy, all recovered. Re-amputation at the hip joint, for diseased thigh-stumps, has proved successful in 4 out of 7 American cases.

# SPECIAL PATHOLOGY AND SURGERY.

---

## DIVISION II.

### INJURIES AND DISEASES OF ORGANS AND REGIONS.

---

#### THE HEAD.

---

#### CHAPTER XXXIX.

##### INJURIES AND DISEASES OF THE SCALP, CRANIUM, MEMBRANES OF THE BRAIN, AND BRAIN.

**INJURIES OF THE SCALP.—WOUNDS.**—The integument covering the skull is liable to wounds resembling those of the soft parts in any other situation. Scalp-wounds may therefore be incised, or lacerated and contused; and these lesions are of very common occurrence. They have two peculiarities worthy of notice—a marked tendency to heal by primary adhesion, however extensive the wound and detachment of the scalp from the pericranium; and, on the other hand, a special liability to the supervention of erysipelas, suppuration, and sloughing. The favourable character of these wounds seems owing to the greater vascularity of the scalp as compared with the common integument; the unfavourable character alluded to seems to be of constitutional origin, erysipelas of the scalp occurring only or chiefly in persons of “broken” constitutional health.

*Treatment* is the same as that of wounds in general; but the circumstances referred to encourage the attempt to solicit union of the scalp, even when extensively incised or lacerated, and detached; and yet render doubtful the issue of even the slightest scalp-wound. The integument should be shaved, and cleansed of any hair, grit, or other foreign body; then laid down and replaced, if detached, and the lips of the wound neatly brought together; strips of adhesive or isinglass plaster being used to retain them in position, aided, if necessary, by a suture here and there. Water-dressing is applied, by a strip of lint, to any part that cannot fairly be drawn together. A bandage may be requisite, but it should be applied as lightly as possible, consistent with its use. Ligatures are not included in this simple plan of treatment, for they are seldom necessary. In the event of *suppuration*, bagging must be prevented by giving a free vent to the matter, from the wound or by an early counter-opening in the most dependent part, and by means of compresses properly applied. With erysipelas or diffuse cellulitis supervening, incisions will be more especially requisite, both to relieve tension and



to discharge matter and sloughs. Exposure of the *bone* is not necessarily followed by exfoliation, or any occasion, therefore, for further interference, to remove dead bone; granulations freely springing up around, and in islets which coalesce, and overspread the bone, the wound heals by this process. Water-dressing or a stimulating lotion, according to the state of the granulations, must be continued as usual, until cicatrization is complete.

Medicinal treatment consists in moderating the circulation by gentle aperients, with a restricted diet. Rest has an important influence, as favouring the process of reparation, and is of the utmost consequence with regard to the liability of cerebral symptoms.

**CONTUSION.**—Without wound, of the scalp, presents the usual characters of such lesion; but the blood-tumour forming, varies with the situation of extravasation, and the localized state of the blood.

Extravasation may occur in three situations; (1) between the skin and the tendinous expansion of the occipito-frontalis muscle; (2) in the loose cellular texture under this muscle; or, (3) beneath the periosteum or pericranium. In either situation, the blood may be infiltrated, or circumscribed more or less in a cavity.

Infiltrated in the dense cellular tissue between the skin and occipito-frontalis muscle, the blood presents a hard unyielding lump; beneath the muscle, it spreads through the loose cellular texture, and gives a crackling sensation when pressed with the finger. Circumscribed extravasation is apt to form a prominent tumour with a soft centre and a hard base, resembling fracture of the skull with depression; for which injury the blood-tumour resulting from contusion may be mistaken, and the more readily if the swelling in connexion with a lacerated artery, pulsates.

The *Treatment* is in no way peculiar. Absorption often taking place, it may be promoted by cold evaporating lotions which check further effusion. Persistent and increasing extravasation justifies evacuation of the fluid, as recommended by Mr. Prescott Hewett. This should be done by a small puncture, after which compression is made and continued over the whole swelling. In large collections, these puncturings may have to be repeated several times; and in an encysted collection of large size, if the fluid has become of a serous character, and recurs again and again, an iodine-injection might be thrown into the pouch.

Suppuration occurring; the bag must, as usual, be laid freely open.

**CEPHALHÆMATOMA**, or blood-tumour of the scalp, forms sometimes, in newly-born children; in consequence of pressure during parturition, or in delivery by obstetric forceps.

The pathology of a blood-tumour thus produced, is much the same as of that arising from an ordinary contusion of the scalp; the blood collecting beneath the tendinous aponeurosis of the occipito-frontalis muscle, or beneath the pericranium. The characters of the tumour are also similar. The treatment must be conducted in like manner. In the only case I have seen, a cephalhæmatoma, of rather large size, over the right parietal bone; time and compression led to a subsidence of the tumour and its gradual disappearance.

**INJURIES OF THE CRANIUM.**—**CONTUSION OF THE BONE.**—Cranial contusion is produced by, and accompanied with, a wound or contusion of the scalp; but it is unconnected with fracture, as being simply a contusion of the bone. Yet the consequences may be very serious or fatal.

*Consequences.*—(1) It may lead to *caries* or *necrosis* of the bone,

affecting one or both tables of the osseous substance; and limited to the seat of injury, or spreading far and wide, even over the whole vault of the skull. In a case related by Saviard, after a blow on the head, the whole skull-cap came away bodily.

(2) *Inflammation of the diploe* is another consequence to be dreaded; such inflammation extending probably inwards to the dura mater, with detachment of that membrane and suppuration between it and the cranium. Thus far the mischief is circumscribed; but the inflammation deepening to the arachnoid membrane, it spreads over the parietal layer, and soon involves the visceral layer; thence the pia mater and corresponding surface of the brain. All the membranes, and the brain, are affected. The periosteum also spontaneously separates; the bone, if denuded, becomes dry and discoloured, and the wound, if there be one, loses its healthy appearance.

The symptoms are insidious and supervene at a variable period, perhaps a fortnight or more after the contusion. The earliest local change is in the appearance of the wound, and the bone if exposed. This is accompanied with pain in the head and feverishness; followed, as suppuration ensues, by sickness, drowsiness, occasional wandering, coma, or paralysis, and death.

(3) *Pyæmia* is apt to arise—possibly, from a simple wound of the scalp, as a third consequence of contusion of the cranial bones. It may occur in two ways; commonly in connexion with intra-cranial suppuration; sometimes, with suppuration of the diploe, the membranes of the brain remaining unaffected, and the veins of the diploe being apparently the source of purulent infection. Its accession is marked by rigors, greatly increased rapidity of pulse, and prostration.

It is very important to bear in mind these three consequences of otherwise *slight* injuries of the head:—death of the bone; inflammation of the diploe, and its associated inflammation of the membranes of the brain, with intra-cranial suppuration; and pyæmic infection.

The *Treatment* of Contusion affecting the Cranial Bones will be given in conjunction with Traumatic Inflammation of the Membranes of the Brain.

FRACTURES OF THE CRANIUM.—These fractures are so intimately related, as causes, to Injuries of the Brain, that they are here considered.

(1) FRACTURES OF THE VAULT OF THE SKULL.—*Structural conditions.*—

Fracture of any part of the vault may be: (a) *Simple Fissure*, or a Comminution of the bone; the former is generally not limited to the seat of injury, sometimes spreading through various bones, and often extending from the Vault into the Base of the Skull; the latter, or *Comminuted Fracture*, is commonly more limited to the seat of injury. *Fissured* and *Comminuted Fracture* may co-exist, and especially when caused by a heavy blow acting on a large surface. *Incomplete Fracture*—

FIG. 319.



*i.e.*, limited to the external, or internal, table (Fig. 319) *alone*, may occur, but comparatively rarely.

(b) *Depressed fracture*; the displacement of the bone being *inwards* (Fig. 320), or *outwards*,—very rarely. Either form of depressed fracture may be *Comminuted*; and the former, or inward depressed fracture, may be a *Punctured fracture*, when it is necessarily comminuted, spicular portions of the internal table being driven in. Traumatic depression of the skull, *without fracture*, is not authenticated by any specimen. In the adult, the existence of such injury cannot be acknowledged; and in children, with pliant bones, some of the bony fibres must be broken.

FIG. 320.



Displacement *inwards* may affect the external, or internal, table alone. The *external table*, Mr. Prescott Hewett observes, may be driven down in any part of the vault, but especially in the region of the frontal sinuses, where the depression may be very extensive, without any injury of the inner table. The *inner table* may be broken and depressed, without a trace of injury about the outer parts of the bone. Such cases are very rarely met with; but extensive splintering and depression of the inner table not unfrequently exist, with some slight injury of the outer table. Fracture of the inner table is always much more extensive than that of the outer table.

Displacement *outwards* may affect the external table only partially. Of such displacement, there are two specimens in the Museum of St. George's Hospital. In both, a piece involving the whole thickness of the bone, having been detached on three sides, is bent outwards, and thus raised two or three lines above the level of the skull; the fragment is immovable, it being still connected at one side to the surrounding bone, the external table of which, at this part, is only partially fractured; the appearances may, in fact, be said to resemble the lid of a box partly open. In one instance, the injury was produced by a chisel falling from a great height on to the head; and in the other, the patient, in a fall from a great height, struck his head upon some iron railings, one of which penetrated his skull.

(c) *Compound fracture*.—A wound of the integument leading down to the bone, may accompany every variety of fracture of the vault. And, the injury of the bone is very much more frequently strictly limited to the seat of the blow than in simple fracture.

*Symptoms, and Diagnosis*.—*Simple fracture*, in any form, is not accompanied by symptoms or signs, invariably, and exclusively, indicative of this kind of injury. *Fissure* may exist, undiscovered during life; and a comminuted fracture with great depression of the fragments, may be concealed by the temporal muscle, or by a large extravasation of blood. On the other hand, either a circumscribed extravasation of blood, or an abnormal depression of the bone, is apt to resemble fracture with depres-



sion. Extravasation into the cellular texture beneath the scalp, raises it, excepting at the part compressed by the contusion. The surrounding swelling thus produced is very firm, and its central margin resembles that of fracture, with depression. Beneath the muscle, extravasation spreads, and yields a crackling sensation on gentle pressure. An abnormal depression of the skull is congenital; or slowly produced by absorption of the diploe and attenuation of the tables, as sometimes occurs in advancing years.

*Depressed fracture* is accompanied by the symptoms of *Compression* of the brain; namely, more or less complete suspension of the cerebral functions of consciousness, sensation, and voluntary motion. The same symptoms may proceed from extravasation of blood, or from the formation of purulent matter, under the cranium. But, with depression, these symptoms are immediate; with extravasation, there was an *interval*, during which consciousness may have been regained more or less completely, as Concussion passed off;—symptoms of compression supervene, and gradually increase with further extravasation; with pus-formation, there was also an interval, during which *inflammatory* symptoms were present, those of compression supervening.

*Compound fracture* may be detected; care being taken not to mistake any natural suture or vascular groove for fracture-fissure. Any abnormal disposition of a suture is especially misleading.

*Causes, and their Effects.*—*Direct violence* is almost invariably the *only* cause of fractures of the cranium in its vault, an etiological distinction as compared with fractures of the base. Falls on the head, and blows with almost every kind of weapon, are the occasions of direct violence. Suicide is sometimes effected by firing a pistol into the mouth. I have seen one such instance; the ball penetrating the base of the skull, and passing through the brain, struck the vertex of the skull; fracturing the inner table, and raising the outer, it fell back into the substance of the brain.

The effects of this mode of fracture are various. In addition to *wound* of the scalp, occipito-frontalis muscle, and pericranium or periosteum; *extravasation* of blood may occur beneath either of these integuments—parts external to the vault of the cranium. Thus, extra-cranial extravasation is found in one, or more, of three situations; between the scalp and the tendon of the occipito-frontalis muscle, between that muscle and the pericranium, or between that membrane and the bone. The *skull*, *brain* and its *membranes*, may be severally and similarly involved, as extensions of the fracture-injury to the contents of the cranial cavity. These effects are produced, principally, by depressed fracture. They are separation of the dura mater from the interior of the cranium, wound of this membrane, of the arachnoid, pia mater, and laceration of the brain; extravasation of blood in the diploe of the skull, or between the bone and dura mater; or into the cavity of the arachnoid; or beneath the arachnoid and in the pia mater; or into the substance, and ventricles of the brain. No certain relation exists between these effects and the extent of depression. Hence also the want of any certain correspondence between the symptoms of compression and the depression; those symptoms being slight perhaps, with considerable depression, and severe with slight depression.

The *source* of hæmorrhage varies. Extravasation between the bone and dura mater may proceed from the small vessels passing from one to the other, or from some of the large vessels lodged in the grooves on the

inner surface of the skull. The former extravasations—observes Mr. Hewett—are, generally, of small size; but the latter may be very extensive, widely separating the membrane from the bone over the greater part of one side of the skull. The middle meningeal artery is the source of these large extravasations, in the majority of cases. It was so in 27, out of 31 cases. One of the large venous sinuses may be the source of extravasation, and the lateral sinus more commonly than any other sinus. The situation of extravasation from the middle meningeal artery, is usually regarded as the anterior inferior angle of the parietal bone; but extensive extravasations may occur from this vessel, or some of its branches, over nearly the whole of the lateral surface of the skull. So also, with fracture of the base of the skull, extravasations from this source are common.

*Intra-cranial extravasation* is attended with *Compression* of the brain; denoted by more or less complete suspension of the cerebral functions of consciousness, sensation, and voluntary motion. But—unlike the immediate compression by depressed fracture—these symptoms supervene after an interval, however short; during which consciousness may have been, more or less completely, regained.

*Consequences.*—(1) *Extravasated blood* remains infiltrated, or becomes encysted and undergoes changes of spissitude and colour. In either of the three situations of extra-cranial extravasation; the primary condition, or this alteration, may be found. But with intra-cranial extravasation; blood effused between the dura mater and bone, or in the pia mater, never seems to become encysted; while in the cavity of the arachnoid, it is liable, even prone, to acquire a perfect cyst, if the extravasation be large, or to form tough membranes; such cyst or membrane becoming provided with blood-vessels. These changes are, however, the work of time.

(2) *Inflammation*, with lymph and pus-formation, within the cranium, is always liable to supervene, in consequence of fracture, and in the same situations as intra-cranial extravasation may occur; namely, in the diploe of the skull, between the bone and dura mater, in the cavity of the arachnoid, beneath the arachnoid and in the pia mater, and in the substance of the brain.

Symptoms of inflammation affecting the bone, the membranes, or the brain; are followed by symptoms of *Compression*, as lymph and pus-formation supervene. But—as with extravasation—an interval of time elapses between the fracture and *these* symptoms; an interval of longer duration, usually several days, during which, however, inflammatory symptoms prevail, instead of consciousness returning.

(3) *Pyæmia*, consequent on fracture of the skull, is mostly connected with inflammation and suppuration of the diploe, implicating some of the numerous and large venous sinuses in the bone.

*TREATMENT.*—The question of operative interference turns principally, on the presence, or absence, of *Compression*-symptoms; and partly, on the presence, or absence, of *Compound-fracture*—a wound already leading to the seat of fracture.

The rules of treatment, accordingly, are thus expressed by Mr. Hewett:—

*Linear fracture or fissure*, unaccompanied by brain-symptoms, even although compound, is not to be interfered with; the wound must be treated according to circumstances, and the case carefully watched for some time.

*Comminuted* fracture, even with depression of the fragments, but unaccompanied with symptoms and a wound, should not be interfered with. It is now an established rule in our Metropolitan Hospitals, that *Simple* fractures, with depression but without symptoms, are to be left alone. The depression may be so marked as to be easily detected; but so long as there are no symptoms, all operative interference, of whatsoever kind, should carefully be avoided.

*Compound* fracture, with depression, although without symptoms, justifies operative interference, and immediately. This rule was inculcated by Sir A. Cooper, and Sir B. Brodie, to prevent intra-cranial suppuration consequent on this condition of fracture. The former authority observes:—"The elevation of the bone is never followed by any mischief; but if you do not raise it, and inflammation follows, it will then be too late to attempt to save the life of the patient." On the other hand, the *presence* of symptoms in this condition of fracture, alone justifies operative interference, in the experience of the late Sir Philip Crampton. "In Dublin"—he remarks—"we conform generally to the rule originally laid down by Dease, who preceded Desault by many years; that, in fracture of the skull with depressed bone, whether complicated by *wound* of the scalp or otherwise, no attempt should be made to raise the depressed bone, unless very decided symptoms be present of compressed or irritated brain."

*Punctured* fracture—sharp splinters of the inner table being driven in, albeit without symptoms—most imperatively demands operative interference.

But, certain *exceptional conditions* of ordinary compound fracture may be noticed. A slight depression, especially when it corresponds to the thicker part of the injured bone, does not require an immediate operation. A deep driving-in of the bone over the frontal sinuses, is another exception; always remembering that these sinuses do not begin to form until several years after birth. A compound fracture with depression, but without symptoms of inflammation, some days after the accident; will justify non-interference, and the more so, if the depression is broad, and the fracture comminuted. Such a condition may proceed to recovery without any intra-cranial inflammation. Thus far, respecting fractures, of the skull *without* brain symptoms, in regard to their rules of treatment.

*Depressed* fractures, accompanied *with* primary brain symptoms.—*Simple* fracture with the symptoms not very urgent, justifies postponement of operative interference; but with urgent symptoms, it demands such interference.

*Compound* fracture, depressed, with symptoms; also demands interference, and immediately. It may, or may not, prove successful, according to the urgency of the symptoms, depending on the fracture-depression.

In childhood, a depressed piece of bone remaining, does not generally produce the serious results, which are commonly noticed in the adult. Postponement of elevation or trephining, is, therefore, allowable; when, in an adult, the operation should be performed at once.

(2) FRACTURE OF THE BASE OF THE SKULL.—*Structural Conditions*.—Commonly a fissured or radiated fracture; there is little or no displacement, the bones being nearly immovable. The fracture may be situated in either the middle, posterior, or anterior fossa of the base, and generally in this order of occurrence—the fissure passing through the petrous por-



tion of the temporal bone, or into the foramen magnum. Two fossæ may be implicated; as the middle and posterior, in 15 cases out of 29; or the middle and anterior, in the remaining 14 cases. All three fossæ may be implicated concurrently; but this happened in only 10 cases in 10 years.

*Symptoms, and Diagnosis.*—The only peculiar and reliable symptoms, of fracture of the base, are; the escape of some of the contents of the skull—*blood*, through the ears, nose, or into the orbit; a *serous fluid*, probably the cerebro-spinal fluid, from the ears, or nose; or *brain-substance* possibly, accompanied with special symptoms of injury to the cranial nerves as they emerge from the skull.

But all these symptoms vary with the *situation* of the fracture.

In the *middle fossa*, there is probably fracture of the petrous portion of the temporal bone, with rupture of the tympanum; and thence the escape of watery fluid, or blood, from the ear. A copious discharge of watery fluid from the ear, immediately after the accident, leaves no doubt that such is the nature of the injury. A copious and prolonged bleeding from the ear, followed by a watery discharge, also indicates the same injury—fracture of the petrous bone. A discharge of blood, neither copious nor prolonged, followed by watery discharge, varying in the time of its appearance and its quantity; renders the diagnosis doubtful. The discharge of blood is—according to recent experience, Mr. Hewett affirms—certainly not of a character to warrant the diagnosis of fracture of the petrous bone; while, a watery discharge may occur a few hours after the accident, and may even be profuse in quantity, and yet there be no fracture. In the *posterior fossa*, fracture is more obscure; unless it extend into the petrous bone. In the *anterior fossa*, fracture is attended with extravasation of blood into the orbit, thence under the ocular conjunctiva, and eyelids—the lower one first, in most cases. Hæmorrhage from the nose also, not unfrequently occurs. But fracture in this fossa may exist without any extravasation under the ocular conjunctiva, or with only discoloration of the lids; and then, the fracture however extensive cannot be diagnosed. Extravasation in both these situations may also arise from fracture of the superior maxillary or malar bones.

Fractures of the base are sometimes attended with extravasation of blood into the cellular tissue of the mastoid region, or at the back of the head.

The *source* of the blood in any case is uncertain; the fracture must involve some of the large vascular channels lying at the base, and also open up a way for the escape of blood externally. Either or both these effects not being produced; very extensive fracture may exist, undiscovered during life. In fracture involving the *middle fossa*, the middle meningeal artery may be ruptured in any part of its course between the foramen spinosum and the anterior-inferior angle of the parietal bone.

The blood is either arterial or venous. Thus, fracture in the anterior fossa, involving the orbital plates of the frontal and extending into the sphenoid bone will lay open the venous sinuses, or the ophthalmic artery, there situated; and more commonly the former.

Vomiting of blood occurs, when during hæmorrhage the blood has passed down the pharynx into the stomach.

*Causes, and their Effects.*—*Indirect* violence is almost invariably the *only* cause of fractures of the cranium, in its base. A heavy blow, or fall, on the top of the head, is commonly the cause; but a fall, the

person alighting on his feet, or the buttocks, is an occasional mode of indirect violence. In either case, the cranium is compressed between two forces, the force of collision on the vertex and that of resistance by the apex of the spinal column; or the latter may be driven upwards, and the top of the head downwards, as in the case of a person falling on his feet.

The production of fracture by indirect violence, at the *opposite* part to the part struck, is designated fracture by *contre-coup* or counter-stroke; the cranium yielding laterally, and giving way at the opposite point of resistance or impulsion. And such was long thought to be the mode in which fracture was produced at the base of the skull. But more recent observations, and especially Dr. Aran's experiments, have shown that, generally, these fractures begin, not at the base, but start from the part of the vault struck, and thence stretch round into the base. In the front of the vault, such fracture thus leads to fracture of the anterior fossa; in the middle or vertex of the head, to fracture of the middle fossa; and at the back of the head, to fracture of the posterior fossa; in each situation of fracture, a line leading from the corresponding part of the vault. Fracture of the base of the skull by *contre-coup* would therefore seem to be of very rare occurrence. *Direct* violence is, comparatively, very rarely the cause of fracture in any portion of the base. But, at certain parts, the bones are thin and brittle, readily yielding to any force directly applied. Such are the orbits, the nostrils, and the occipital fossæ. Sharp-pointed instruments, as scissors, or a tobacco-pipe, may penetrate the cranial cavity in these situations, and also injure the brain. The condyle of the lower jaw has even been driven into the middle fossa of the base.

The immediate effect or operation of either indirect or of direct violence is by its extension to the vessels at the base of the brain, to the membranes, and brain, or cranial nerves. Hence, extravasation of blood, the escape of cerebro-spinal fluid, or even of brain-substance, and injury to the nerves emerging from the skull.

*Terminations.*—(1) Fracture of the base,—the more common form of fractures of the skull, is very frequently fatal. (2) In the event of recovery; no union may have taken place, after months or even years; or, union partly by dense fibrous tissue with a thin layer of inlaid bone; or, bony union, and throughout the whole line of fracture. In some of the latter cases, porous bone has been found heaped up along the sides of the line of fracture, on the inner aspect of the skull, and even blocking up one of the venous sinuses.

*Treatment.*—No operative interference is requisite, or practicable, in fracture of the base. Itself remaining without displacement, the brain-lesions alone assume the whole consequence of the injury. Trephining has, however, been performed successfully, close to the foramen magnum.

**INJURIES OF THE MEMBRANES OF THE BRAIN.**—*Extravasation of Blood within the Cranium.*—Intra-cranial extravasation, in connexion with Injury of the Head, may occur with, or without, Fracture of the Skull. But the pathology of extravasation, thus arising, is the same;—with regard to the situations of effusion, the symptoms, and consequences. These have been already described.

The *Treatment* is that of Compression.

**HERNIA CEREBRI.**—Protrusion of the brain-substance is liable to occur in connexion with laceration of the brain and its membranes, communicating with compound fracture of the skull. The projecting portion of

brain not having any integumental covering is not properly speaking a hernia, and is sometimes designated *fungus cerebri*. It may present itself in any part of the skull; but commonly in some part of the vault, and especially the frontal and parietal regions. It rarely occurs at the base of the skull; brain-substance then being forced through the ear, nose, or possibly into the pharynx.

The appearances are those of brain-substance, more or less modified; as having a brown colour and bloody character. Nerve-tubules, with the products of inflammation, may be discovered under the microscope. The more obvious appearances as well as the microscopic characters, will therefore distinguish brain-substance either from a collection of blood protruding under the pia mater, or exuberant granulations from the brain. And, moreover, *hernia cerebri* is continuous with the brain.

The causes of *hernia cerebri* would seem to be, the loss of a portion of bone,—hence rare in fracture of the base—and compression of the brain, resulting from inflammation with the effusion of lymph and pus. The surrounding portion of brain becomes congested, and undergoes yellow softening and disintegration, abscesses form in the hemisphere, and effusion distends the ventricles. The products of inflammation occupy also the cavity of the arachnoid and the sub-arachnoid tissue. Protrusion may occur as the immediate consequence of fracture, but more frequently, at a subsequent period,—days or weeks afterwards, when inflammation is established. The symptoms then, are those of inflammation of the brain and its membranes, and such as may exist without any protrusion.

The course, and terminations of *hernia cerebri* are peculiar. Varying in size and shape, according to the aperture in the dura mater through which it had to pass, the tumour gradually increases in bulk, even forming a large mass overlapping and concealing the wound in the scalp; daily breaking down and sloughing, the tumour is constantly reproduced by further protrusion. Few symptoms, perhaps, of cerebral disturbance accompany this course of destruction, but at length death ensues, as the usual issue. Occasionally the tumour sloughing, or shrinking, it wastes away, and cicatrization of the wound follows; the patient recovering without any apparent impairment of his brain-power. This has occurred after a very large protrusion; in one remarkable case, published by Mr. Spring, in the Lond. and Edin. Month. Journ., 1844, the patient lived eleven years, and after death, the left side of the cranium is said to have been found quite empty.

*Treatment.*—As a general rule, *hernia cerebri* should not be interfered with; and no removal of the tumour is allowable, whether by slicing it off, or by ligature. Cleanliness by gentle syringing with cold water, and water-dressing; may be assisted by slight pressure, when the protrusion is small. Any splinter or depressed fragment of bone, or other foreign body, should be extracted, when accessible without undue risk; and particular care must be taken in such operation, not to injure the dura mater.

**INJURIES OF THE BRAIN.—CONCUSSION.**—Literally signifying a shaking, more or less severely; this also is the pathological meaning of the term concussion. Concussion of the brain is a shaking of the brain.

(1) No lesion of the brain may be discovered after death; and it was formerly held, or it is perhaps still maintained by some Surgeons of authority, that concussion may prove fatal immediately, without a trace of injury to, or in, the brain-substance. But of late years, this doctrine



has been disproved by more careful post-mortem examinations. It is now held by several pathologists who have specially investigated cerebral affections; that, in concussion, instantaneously fatal, appreciable lesions are to be found in the brain. These lesions may be various; points of extravasated blood, numerously scattered, or circumscribed patches of contusion or bruising; on, or in, the brain-substance. Such is the pathology of concussion of the brain, as shown by Chassaignac, Nélaton, Sanson, Dr. Bright, Blandin, M. Fano, and enforced by the observations of Mr. Prescott Hewett.

(2) In concussion, not immediately fatal, where life continues for a short time or a few hours, another result is found;—intense congestion of the cerebral vessels and permeating the whole brain-substance; without perhaps any actual lesion.

(3) Slight concussion, followed by recovery, is probably connected with similar injury to the brain and congestion; varying only in degree, but having no definite proportion to the previous symptoms of concussion. This state of disorganization of the brain is sometimes verified by post-mortem examination, after slight concussion, when death has occurred from some other injury. Mr. Hewett describes two such cases.

These are the only essential lesions in concussion of the brain, as authenticated by more recent observations. The question, in both a positive and negative sense, is obviously of much importance Surgically, and no less so from a Medico-legal point of view.

*Symptoms.*—The symptoms of concussion of the brain are, essentially, loss of *consciousness*—comprising a suspension of all the functions of the brain, as the direct and immediate effect of the injury. The person is stunned. Three degrees of this state are now commonly recognised—(1) *Slight* concussion; with momentary loss of sensibility and of muscular power; and with depression of the circulation, as denoted by a feeble pulse at the wrist. These symptoms soon pass off; the person comes to again, and proceeds about his business as if nothing had happened, retaining, often, no knowledge of the injury. (2) *Complete* insensibility; the patient lying motionless, pallid, and cold, the pulse scarcely perceptible. The pupils of the eyes vary very much, being contracted or dilated; or one contracted and the other dilated. The breathing is feeble, but, in the majority of cases, easy. The urine and fæces are sometimes voided involuntarily. This state having continued for a period of longer or shorter duration, imperfect sensibility returns; the patient can be roused to answer a question with bewilderment of manner, and then relapses; vomiting supervenes as a symptom of recovery, and the symptoms of concussion gradually pass off in a few hours or days. Head-ache, confusion, and giddiness remain, or symptoms of intra-cranial inflammation supervene. (3) *Complete* insensibility, and the *pulse imperceptible*. No reaction ensues, and death takes place in a few minutes or a few hours.

The *diagnosis* of concussion and compression of the brain, will be considered in connexion with the latter state.

The *cause* of cerebral concussion is, of course, external violence, applied directly to the head as by a blow or fall; or indirectly, by transmission through some other part of the body, as when a person falling from a height alights on his feet.

*Consequences.*—*Inflammation* of the brain, or its membranes, is always liable to ensue, even from slight concussion, and after an interval of apparent health. The approach of inflammation may be very insidious, and its

results permanent, in the impairment or loss of various cerebral functions. Thus, the memory fails with regard to places or persons, dates, or the recollection of certain words. The special senses become impaired, as by loss of sight, with paralytic falling of the upper eyelid,—ptosis, or squinting; and one or both eyes may be affected. Loss of hearing is sometimes experienced, or various disturbing sounds in the head are heard, and smell or taste may be perverted. Sleeplessness or horrible dreams complete the misery of these purely-cerebral affections, and paroxysms of maniacal excitement are apt to be induced by any slight indulgence in drink, or by any other occasion of cerebral influence. The muscular strength declines, and the sexual power becomes impaired; while the general health, as depending on innervation, is reduced, and the patient brought to a cachectic, broken, state, the very shadow of his former self. Strange to say, the pulse may remain unaffected, or remarkably slow, as if not indicative of any inflammatory mischief in the brain; and this seems to be more particularly observed when the base of the brain is the seat of such morbid change as declared by the character of the functional symptoms. These results I have had the opportunity of witnessing in several cases, consequent on concussion by railway injury, in which I have been engaged; but it is to be regretted that, in some such cases, their issues cannot be ascertained.

*Treatment.*—The pathology of concussion supplies two general indications of treatment; to prevent increasing congestion or the tendency to inflammation, and to give time for the cerebral lesions to recover themselves. Hence, in the *stage of depression*, or insensibility, interference should be little, and judicious; on the one hand, not to increase congestion by blood-letting or other reducing measures, on the other hand, not to hurry on reaction and the tendency to inflammation, by over-stimulation. Stimulants should be administered in proportion to the depression and its continuance, as evinced by the state of the circulation and pulse. But it should be remembered, that while slight depression will be followed by slight reaction, extreme depression will be succeeded by extreme reaction, and this, therefore, would be aggravated by over-stimulation previously. In the stage of *reaction*, interference should be regulated by its degree, as bordering on inflammation. An elevated position, with cold lotion, to the head, shaved for its application, are the best safeguards. A reduced diet and abstinence from stimulants, coupled with the administration of gentle, watery, aperients, will effectually keep the circulation in check. Any tendency to relapse must be watched at the same time, and prevented by recurrence to stimulating treatment.

Absolute rest, and the withdrawal of all surrounding circumstances of excitement, are imperatively necessary to recovery. A quiet life should then be led, for some time; and, if possible, the patient continue under medical supervision. It was justly remarked by Liston, that no injury of the head is too trivial to be despised, or too serious to be despaired of.

Intra-cranial Inflammation, and its consequences, as arising from Concussion, will be considered under the general heading of Traumatic Inflammation of the Brain.

**CONTUSION OF THE BRAIN.**—Bruising and laceration of the brain-substance is associated with concussion, but it may be the most prominent form of lesion. Consisting of spots of extravasated blood and disintegrated brain-substance; these are commonly clustered together in well-marked, circumscribed patches, or occasionally scattered and diffused

throughout various parts of the cerebral mass. In the one form of contusion, the grey substance alone is affected, in other form, the white substance also.

The *situation* of contusion may be either at the spot where the skull was struck—direct contusion, or distant from the seat of violence—contusion by contre-coup. The middle and anterior lobes, and especially their under-surface, are more frequently bruised than the posterior lobes.

The *symptoms* are, unconsciousness more or less complete, without stertorous breathing; tonic spasms of the limbs, and a restless rolling and tossing about in bed. But these symptoms are not immediate, and therefore not necessarily dependent on contusion. This kind of lesion has no symptoms of its own. They have been said to denote cerebral irritation, as a primary form of cerebral disturbance, arising from injury. But the symptoms are not only of subsequent origin, they are also not peculiar. I have seen precisely the same symptoms connected with an abscess in the right posterior lobe of the brain.

**COMPRESSION OF THE BRAIN.—Symptoms.**—The symptoms of this condition, when fully established, are; insensibility, or coma, as of a profound sleep; the breathing is laborious, slow, and prolonged, accompanied with a stertorous or snoring noise, owing apparently to paralysis of the velum palati, and a puffing blowing of the lips; this sound dying away now and then, it may be succeeded by a sort of catch in the throat, with a start, and relapse into deep snoring; the pupils are dilated, and the pulse is slow and full. The *fæces* may pass involuntarily, and the urine be retained, or dribble away. This general state is sometimes varied by attacks of delirium or convulsions.

*Diagnosis.*—The distinction between compression and concussion has been generally determined—mainly by the three symptoms, of the breathing, the state of the pupils, and the pulse; as already described with reference to each of these conditions of the brain. In typical, or well-marked representations of either condition, it will be possible thus to decide the question of their diagnosis. Much stress has, therefore, been laid on the aforesaid distinctive characters. But in intervening states of cerebral injury, the diagnosis is equivocal. Mr. Hewett affirms that “there is no one symptom, or combination of symptoms, which will enable us to determine positively between concussion and the slighter cases of compression.”

The *causes* of compression agree in their general nature; they are all some source of pressure on the brain; they vary in being—a depressed portion of bone, a depressed fracture, or other impacted foreign body, extravasated blood, or a collection of matter, within the cranium; and thus these causes differ widely in their pathological origin and significance. Two such causes may co-exist, as depressed fracture, with extravasation of blood; or all may co-exist, as intra-cranial suppuration, with depressed fracture, and extravasation.

*Consequences.*—*Inflammation* of the brain, or its membranes, is equally liable to ensue as from concussion, although the cause of compression will affect the probability of this event. Depressed fracture inevitably leads to inflammation, and intra-cranial suppuration presupposes it. Death results from continued compression, in a period varying with the degree of pressure, and the functional importance of the part of the brain affected.

A stationary condition of compression remains occasionally; the patient lying comatose for weeks, or months, and recovering consciousness when



the compressing cause is removed. A most remarkable case of this result is recorded by Sir A. Cooper, that of a man whose cerebral functions were entirely suspended for a period of thirteen months, by a fall on his head from the yard-arm of a vessel, producing a depressed fracture; but, on trephining the bone, and thus removing the cause of compression, consciousness returned immediately after this long period of total oblivion—for more than a year.

*Treatment.*—Obviously, the compressing cause must be removed. This implies a different mode of proceeding according to the particular cause in operation.

The head should be shaved and carefully examined. (1) *Depressed fracture* will probably necessitate the elevation of the depressed portion of bone, by means of an elevator, or its removal, by trephining. The conditions which justify these operations have been already enumerated in the rules of Treatment pertaining to Fractures of the Cranium. The question of removing a foreign body, as the cause of pressure, may be determined by the same code of rules. (2) *Intra-cranial extravasation of blood*, can, generally, be treated without recourse to operative interference. The compressing cause is the same as that of apoplexy. Hence the extravasation of blood may be arrested and reduced, by cold applications to the head, and by the depletory action of purgatives. No form of purgative seems to act so speedily and impressively on the brain, as a turpentine enema; say, an ounce of turpentine to a pint of gruel, the strength which I am in the habit of ordering. Its beneficial influence should be aided by bottles of hot water to the feet, and similar means of derivation from the brain. It would be highly important to know, whether a more powerfully derivative action could be established, by means of the suction-apparatus applied to either of the lower limbs; such as was, I believe, originally employed, under other circumstances by Mr. Jobert. (3) *Intra-cranial suppuration*, is always a question of considerable difficulty, as to its existence and situation. This will be considered, and the necessity of having recourse to the operation of trephining, in describing Traumatic Inflammation of the Membranes of the Brain.

WOUNDS OF THE BRAIN, arise from Fracture of the skull, or the simultaneous penetration of some instrument, or other foreign body. Such lesions, therefore, scarcely require a separate notice.

But the *symptomatic effects* differ from those of concussion and compression. A great part of the brain of an animal—observes Mayo—may be gently and quietly sliced away with little or no effect, but if ever so small a portion be suddenly crushed, the heart stops directly. Thus also with regard to wounds of the human brain; Cole, in his “Field Practice in India,” narrates certain apposite facts.—“The English dragoon sword is so blunt, that the strongest man cannot drive it through the head-dress of the Sikh or Afghan; yet, the enemy is most often beaten from his horse, and frequently killed by the violence of the shock. Not so, however, with the trenchant blade of the Sikh; this weapon, wielded by a strong man, will cut through any head-piece, and bury itself perhaps in the brain, and yet you find no symptoms of concussion or compression. In the former example, the soldier is effectually disabled, often killed outright; in the latter, although the individual is mortally wounded, he may be able to continue the fight, and even to kill his antagonist, before he falls himself, dead or dying from his horse.”

INJURIES OF THE CRANIAL NERVES.—In connexion with injury of the

Brain or its Membranes, one or more of the cerebral nerves are sometimes involved, and their functions impaired.

The *causes* of such injuries and functional impairment, are various, and the same as those of Brain-injury. Thus, one or more of the cerebral nerves may be injured by an *instrument* producing fracture. This mode of lesion, a rather rare occurrence, is more liable to happen to certain of these nerves, owing to their more accessible situation; the optic and olfactory nerves being especially liable to be injured by a thrust-wound. The *fracture* itself may implicate one or more of the foramina or canals, through which some of the cerebral nerves emerge from the base of the skull. Certain nerves are more frequently thus injured than others, owing to the relative frequency of fracture in these situations. The seventh nerve, on account of the frequency of fracture through the petrous portion of the temporal bone, is often injured in this manner; paralysis of the facial or auditory nerve generally denoting fracture of the base of the skull. A portion of broken bone, distant from the foramen or canal of transmission, sometimes occasions injury to a nerve with which it is connected. *Extravasation* of blood at the base of the brain may affect a cerebral nerve, by pressure on the brain at the origin of the nerve, or on the nerve in some part of its course. This mode of paralysis is more temporary; absorption proceeding, it gradually disappears.

The *Treatment* of these implications of the cerebral nerves, is chiefly negative. The natural process of reparation after any such injury and the restoration of function, will probably prove more effectual, than any blind interference. If the lesion depend on extravasated blood, we know too little of the remedial efficacy of mercurials and blistering for promoting absorption, or of nerve-tonics, for restoring nerve-function, to regard these measures with much confidence.

TRAUMATIC INFLAMMATION OF THE BRAIN, AND ITS MEMBRANES.—Pathologically considered, Inflammation may affect the Brain or its Membranes, separately; and when of traumatic origin, it may be appropriately named Traumatic Encephalitis and Traumatic Meningitis, respectively. Practically considered, however, these affections are identical, the one giving rise to the other; and both may be described as Inflammation of the Brain.

*Symptoms.*—The symptoms of traumatic intra-cranial inflammation are principally these;—pain in the head, more or less intense, limited to the seat of injury, or spreading thence over the whole head, contraction of the pupils, intolerance of light and sound, with general feverishness as denoted by a rapid pulse and hot, dry, skin.

These symptoms, becoming more marked, are succeeded by special disturbance of the brain-functions;—delirium or wandering, sickness, restless tossing about, and perhaps convulsions. The aspect of the patient is, indeed, sufficiently characteristic—the excitement and agitation, wild glistening eyes, flushed face and throbbing carotids, all indicate the state of the cerebral circulation.

The *second stage* contrasts very much with that of excitement. Drowsiness, stupor and coma, with dilatation of the pupils, spasmodic twitchings of the muscles, paralysis, and relaxation of the sphincters; indicate effusion, and compression of the brain. Rigors, announce supuration.

The structural alterations or appearances resulting from inflammation of the brain, and membranes, vary according to the seat and progress of

the inflammation. They may be summarily enumerated as follow:—suppuration in the diploe; lymph or pus of a greenish yellow colour, circumscribed on the outer or cranial surface of the dura mater between it and the bone, and diffused beneath this membrane within the cavity of the arachnoid, and on the pia mater filling its meshes and prolongations between the convolutions; so that the membrane thus thickened can be removed as a whole from the brain and looks as if it had been cast in wax. Softening of the brain-substance, abscess in the central part of the brain or cerebellum, and effusion of serum in the ventricles; constitute the alterations peculiar to the brain. The veins are more or less engorged with blood, and the venous sinuses contain coagula.

All these appearances however may not co-exist in any one brain, as the results of inflammation.

The *causes* of intra-cranial inflammation, consequent on injury of the head, are the various conditions of injury already described. Thus, scalp-wound, and contusion of the cranium; fractures of the skull, with injury of the membranes of the brain; concussion, contusion, compression, and wounds of the brain; these several forms of lesion are the starting points of inflammation.

The train of symptoms above mentioned, supervene at a variable *period* after injury of the head; and this question of time has a tolerably definite relation to the cause of inflammation, thereby indicating the probable source of the symptoms. If dependent upon concussion, the symptoms of intra-cranial inflammation appear at a very early period—perhaps within a few hours; as arising from contusion of the brain-substance, they generally supervene about the fourth or fifth day; whereas from contusion of the bone, the inflammatory mischief may smoulder for a time—many days, or two or three weeks, and then suddenly burst forth.

The *prognosis* of intra-cranial inflammation is always precarious, and especially in the second stage, that of effusion or suppuration with coma.

*Treatment.*—The head should be shaved, and raised in an elevated position; and cold lotions or an ice-bag be applied. Free purgation must then be brought into action, and blood-letting in some form. Local bleeding by means of leeches applied to the temples, or cupping on the nape of the neck, will always be advantageous; general blood-letting may be had recourse to according to the severity of the symptoms, and small repeated bleedings are safer and make a more permanent impression on the cerebral circulation than one large blood-letting. Antimonial salines prove useful adjuncts to these depletory and sedative measures, by continuing their influence on the system. Opium had better not be administered in large or opiate doses; although, in the form of morphia, it may be given to control furious delirium. Calomel, in small doses, combined with opium, should be pushed to salivation. These measures must be followed up by derivation from the head, by blisters applied to the nape of the neck or the head. A blistering-cap is used by the French Surgeons, and dressing the blistered surface with mercury, has sometimes been most effectual for restraining effusion in the second stage of inflammation.

The state of the viscera, and of the kidneys in particular, should always be examined thoroughly—as recommended by Mr. Hewett—in relation to both the diagnosis and treatment of inflammation of the brain, arising, apparently, from any injury of the head.



*Compression* of the brain, indicated by coma, and as depending on *suppuration*, may justify recourse to the operation of trephining. But under what circumstances? Rigors are the surest sign of suppuration. Then, with coma, and especially with hemiplegia, the question is the *situation* of the matter. Scalp-wound injury, or contusion of the bone, will generally indicate the spot. The matter may be located between the bone and dura mater; or *also* beneath this membrane, although very rarely circumscribed within the cavity of the arachnoid,—the dura mater then bulging up tensely into the trephine-aperture, and not presenting any pulsation. An incision must be made and the matter let out.

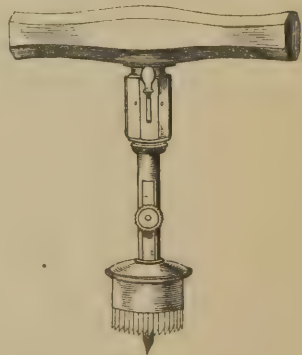
The operation will, therefore, be effectual in these two *exceptional* conditions—(1) for the evacuation of matter *beneath* the *cranium*, alone; (2) or associated with its *circumscribed* formation *beneath* the *dura mater*, in the cavity of the arachnoid.

(3) Abscess in the *Brain* may be superficial or deep. The difficulty will be to determine this question. Having trephined the skull, in consequence of compression-symptoms, one of two conditions may be found. Matter may at once escape through an opening in the dura mater, that membrane having sloughed over a communicating abscess. The difficulty is solved. But if the membrane be entire, without bulging under the trephine-aperture, and with symptoms still of compression; the question again arises as to the situation of the matter, superficially or deeply in the brain? In this doubtful condition, the dura mater has been divided; yet the patient has died with an abscess then only discovered, situated just below, under the cortical substance of the brain, and thus provokingly close to the trephine-aperture; or again the abscess, so placed, has burst subsequently, and the patient entirely recovered. The one case—that of leaving the brain intact with a fatal result, happened to Roux; the other, that of natural evacuation of the matter ensuing with recovery, happened to J. L. Petit. The fair inference is this—that if an abscess can be reasonably suspected to be situated *superficially*, as shown by the state of the brain at the part exposed, a slight incision into the brain may then be made to discover and evacuate the matter. *Deep*, or central abscess, also, might be interrogated in the same way, and for similar reasons. Dupuytren plunged a knife into the brain, and at once saved the life of his patient; Dr. Detmold also made deep incisions into the brain, on three different occasions in the same case; the first saved the man from impending death; the latter two, touching the left ventricle, seemed to afford the only chance of recovery. But it is not probable that such deep incisions will be repeated by other Surgeons.

OPERATION OF TREPHINING. — The conditions of Head-injury, with compression, which render this operation necessary or judicious, having been already fully considered, the operation itself remains to be described.

The instruments requisite are, a trephine (Fig. 321), small or large-sized, according to the purpose of the

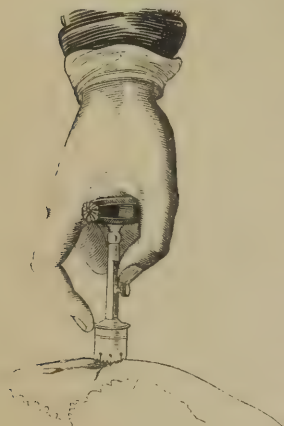
FIG. 321.



operation—either the removal of a portion of bone as the source of compression, or the evacuation of subjacent fluid, extravasated blood, or pus. An elevator, and Hey's saw, are the only other special instruments.

The head is to be shaved around the seat of operation; the bone, if not already exposed by a scalp-wound, must then be laid bare by a crucial, or T-shaped incision. The trephine, with its centre-pin protruding and fixed into the skull, should be worked from left to right, with a firm moving, but light-bearing, action. (Fig. 322.) A fair groove having been thus made, the steadying centre-pin is no longer necessary, and should be withdrawn, lest, passing more deeply, it penetrate the skull first and wound the brain. Complete division of the outer table, and entrance into the diploe, will be plainly shown by the altered character of the *détritus* thrown up by the saw—the dry, white, flour of the hard bone being succeeded by bloody and soft grit. A sensation of yielding in entering and passing through the diploe is also very perceptible. It should be remembered that no diploe will be found either in children or the aged. The instrument must now be worked very lightly and cautiously, and withdrawn every turn or two as it approaches the *dura mater*, in order that the groove may be examined with a probe to ascertain the

FIG. 322.



depth and uniformity of penetration around the circular piece of bone. When it seems loosened, an elevator is gently introduced into the groove, and the portion of bone removed.

The particular object of the operation can now be accomplished. Pus or blood will escape or may be evacuated; or a depressed portion of bone can be raised, by insinuating the elevator beneath it and bearing on the finger or the edge of the firm bone as a fulcrum. This implies that in trephining for fracture, the circular piece of bone removed must communicate with the edge of the depressed portion and afford space for its elevation. Sometimes, a projecting portion of bone can be removed with a Hey's saw, or bone-pliers, and space thus made for the introduction of the elevator, without using the trephine. Certain parts of the skull are also ineligible for trephining—namely, over the occipital bone, in the course of the venous sinuses, and over the frontal sinuses. In the latter situation, however, the outer table may be first removed and then the inner. In any situation, loose fragments or *débris* of bone must be carefully picked or brushed out, and the wound gently sponged clean; the scalp is then laid down, retained with a few sutures, if necessary, and a strip of water-dressing applied.

The *after-treatment* consists entirely in measures preventive or curative of inflammation and its consequences.

The *results* of this operation have been very unfavourable. In the Parisian Hospitals, Nélaton reports of 16 cases during fifteen years, that all have terminated fatally; this mortality, however, including cases that would have died from the injury of the brain for which the operation was performed.

In the Hospitals of Great Britain,—England, Ireland, and Scotland, the mortality although very high, has been much less; and in those of the United States, the proportion, according to Seuter and Gross, is 1 recovery to 4 deaths. The chance of only 1 to 4 in favour of life is sufficient to justify the operation under the pressing circumstances for which alone it is now resorted to,—as the sole chance of preserving life.

**TUMOURS OF THE HEAD.**—(1) The *Scalp* is liable to be the seat of Cysts or Wens, containing sebaceous matter; or Vascular tumours, as Nævi. These Growths do not require any special notice.

(2) The *Cranium* may be the seat of various tumours, the principal forms of which are four in number; ivory exostosis, situated perhaps near the orbit, or on other parts of the cranium; fibrous or fibro-cystic tumour; myeloid tumour; and cancer. Their leading symptoms, diagnosis, and treatment, are conveniently exhibited in the following tabular view, by Mr. T. Holmes.

<i>Tumours of the Skull.</i>	<i>Leading Symptoms.</i>	<i>Diagnosis.</i>	<i>Treatment.</i>
Exostosis.	A small and very hard tumour, growing very slowly, unaccompanied by any symptoms except in very rare cases, when it grows from both tables, or in the orbit and displacing the globe.	From diseased enlargements of the bone; by the presence of symptoms in the latter, and by their less distinct and circumscribed outline.	Operative interference is seldom justifiable.
Fibrous or fibro-cystic.	A slowly-growing tumour, more soft than exostosis, and more liable to affect the brain by growing inwards.	From exostosis, as above; from cancerous tumours by its less rapid growth, and by the other usual diagnostic marks; from fibrous tumour of the dura mater the diagnosis is obvious before perforation of the skull has taken place, but impossible afterwards.	No interference is permissible. Life may be prolonged many years even after the tumour has produced pressure on the brain and cerebral symptoms.
Myeloid.	The same observations apply to the symptoms, diagnosis, and treatment, of these forms of tumour; with the exception that their course is more rapid, and that in all other respects they bear a closer resemblance to cancerous disease.		
Cancer.	Circumscribed pain in head; soon followed by the appearance of a tumour, or by softening and pulsation at the seat of pain. The tumour grows rapidly, and soon produces pressure on the brain. Malignant cachexia is usually well marked. The skull is usually thickened around the tumour.	From innocent tumour, by its more rapid course and by the constitutional symptoms. From hernia cerebri, following absorption of the skull (very rare), by the greater violence of the pulsation, the absence of the movement of the brain dependent on respiration, and the less uniform consistence of the tumour. From vascular tumour (or aneurism by anastomosis), by the cerebral symptoms induced by pressure, and by the signs of cancer.	No treatment is possible.

(3) *The Brain, and its Membranes.*—(a) *Fungous Tumours of the Dura mater.*—Originally described by Louis under this general heading, different kinds of tumour are comprised; some being innocent and some malignant. They all, however, agree in certain particulars, can hardly



be diagnosed from each other, but must be carefully distinguished from other forms of tumour. They are non-congenital, and thus distinguished from nævi and from hernial tumours; and they perforate the skull, which distinguishes them from aneurism by anastomosis and from ordinary solid tumours. At an early period, a general diagnostic sign is the presence of a thin crackling parchment-like layer of bone over the tumour.

The penetration of any tumour through the skull is made known by pulsation communicated from the subjacent brain, and by the cerebral symptoms which pressure on the surface produces; sometimes also, the margin of the opening in the skull can be felt. The tumour is seldom very prominent—often hardly raised above the surface of the skull, but feels like a soft pulsating spot in the bone. Such pulsating tumours may be single or multiple. According to the activity of their pulsation, some diagnosis may be made between these tumours. Active pulsation will probably denote soft cancer; pulsation communicated from the brain may indicate fibrous or fibro-cellular tumour. Some of these perforating tumours are not entirely of intra-cranial origin, but spring also from the diploe of the bone; and thus the diagnostic character of pulsation becomes very equivocal.

The *course and termination* of these tumours depend entirely on their nature. The innocent tumours are assuredly not necessarily fatal; a fibrous tumour of the skull and dura mater has been known to produce occasional symptoms of compression for more than fifteen years, and yet the patient died at a tolerably advanced age, and of another disease unconnected with that on the skull.

No *treatment* of any operative kind for the removal of these tumours, will be warrantable or effectual.

(b) *Congenital Hernial Tumours of the Brain, and Membranes.*—Encephalocele and Meningocele are hernial tumours, respectively, of the brain and its membranes, or of the membranes alone, the protruding bag being filled with sub-arachnoid fluid; and both kinds of tumour result from congenital deficiency of the bone in some part of the skull, usually the occiput. The tumour thus formed varies in size from a pea to a protrusion exceeding the child's head; it is soft, rounded, and bluish in colour where covered by thin skin. Such a tumour resembles nævus; in its congenital formation, colour, and increasing size when the child cries; and it is also difficult to distinguish from congenital encysted tumour. The subject of this malformation is usually still-born or dies early; occasionally the child lives to an adult age.

*Treatment* by any operative interference will scarcely be justifiable. But,—as with spina bifida—when the protrusion is rapidly increasing and threatening to burst, a puncture, followed by evenly adjusted support, may be resorted to. In one case, an encephalocele was sliced off, and the patient survived.

*HYDROCEPHALUS, and PARACENTESIS CAPITIS.*—Sometimes the Surgeon is called upon to puncture the head, to relieve symptoms of compression in an otherwise fatal case of hydrocephalus, in childhood. This operative procedure consists in introducing a very fine trocar and canula, perpendicularly through the anterior fontanelle, away from the longitudinal sinus. Two or three ounces of the serous fluid having been allowed to escape, the puncture is closed with a piece of lint, and the temporary support of a bandage to the head may be advisable. The operation may have to be repeated occasionally, at perhaps intervals of two or three weeks.

## ORGANS OF SPECIAL SENSE, AND THEIR APPENDAGES.

## CHAPTER XL.

## OPHTHALMIC SURGERY; OR INJURIES AND DISEASES OF THE EYE, AND ITS APPENDAGES.

A CONDENSED view of the Injuries and Diseases of the Eye, will meet the requirements of the Student and the Practitioner, in the special department of Ophthalmic Surgery, as part of a general work on Surgery.

## INJURIES.

WOUNDS.—(1) The *Eyebrows* and *Eyelids* are liable to the Injuries of other soft parts.

*Incised* wounds or cuts are of common occurrence, whether by accident or violence. The mobility of these parts, subject to the twitching action of the corrugator supercilii and levator palpebræ muscles, disturbs the process of adhesion and renders cicatrization irregular, with proportionate disfigurement and probable eversion or inversion of the lid.

The consequences of any such wound may be serious, although the Eye itself escape direct injury; loss of vision ensuing from concussion of the retina or effusion of blood in the eye.

The *treatment* of the wound is simple. The lips of integument must be evenly adjusted, and retained by two or three points of fine suture, as the extent of incision may require. Water-dressing and rest will then probably prevent inflammation, and promote union.

(2) The *Eye* itself is also liable to the lesions of other soft parts; but, being lodged within the cavity of the orbit, it more frequently escapes injury.

*Wounds* are, however, met with occasionally. An *incised* wound or clean linear cut, may be caused by a piece of glass, or the edge of some cutting instrument. Both these occasions of incision I have seen. In the latter case, the end of a sharp chisel suddenly broke off and flew into the eye of a man who was using the instrument, dividing the cornea and lodging deeply in the globe of the eye. It was withdrawn by Mr. Murphy, Senior House Surgeon at the Hospital. The fragment measured,  $\frac{3}{4}$ ths of an inch in length,  $\frac{1}{8}$ ths in breadth; and it weighed 39 grains. Subsequently I extirpated the eyeball on account of cerebral symptoms, and threatened sympathetic affection of the other eye. The patient made an excellent recovery, and that eye remained unaffected.

Prolapsus of the iris may arise from an incised wound of the cornea; the aqueous humour escaping, and the iris protruding through the wound.

*Penetrating* wounds of the eye are of a lacerative character, being produced, in most cases, by some blunt-pointed instrument; which not unfrequently passing beyond the eye or to one side of it, may penetrate the orbit also, and the brain; fracture and wound of the brain thus most seriously complicating the injury, or proving fatal. Such wounds have been occasioned by a fork or steel pen, by a thrust with the point of an umbrella, or a spine of wood abutting from a tree and meeting the eye of a person who was running through a wood. An explosion of gunpowder may throw grains of powder into the eye, or grit by the force of explo-

sion; or a stray shot from a gun may enter the eye. Both the eyes of Mr. Fawcett, M.P., were accidentally destroyed by a shot which centrally penetrated the cornea of either eye. In the diabolical outrage at Clerkenwell by the firing of a barrel of petroleum and gunpowder, both eyes of a little boy—one of the victims under my care at the Royal Free Hospital—were destroyed, and his mother lost her left eye entirely in like manner.

The *consequences* of any *penetrating* wound are always formidable. The eyeball is disorganized, either by the wound or by consequent sup-puration, followed by prolapsus of the iris; or the eye itself escaping injury, amaurosis ensues either from lesion of the optic nerve or as the result of sympathetic irritation of other orbital nerves. A penetrating fracture of the orbit, and wound of the brain, have obviously most serious consequences. In one case recorded by Nélaton, a singular result followed. The cavernous sinus and internal carotid artery on the opposite side were wounded by the thrust of an umbrella into the orbit; an arterio-venous aneurism formed protruding the eyeball, and fatal hæmorrhage ensued. Lastly, loss of vision in the other eye may result from sympathetic irritation, transmitted apparently through the optic commissure.

*Treatment.*—Nothing, of course, can be done to a wound of the eyeball to facilitate repair of the lesion itself; but the consequences of inflammation with regard to this organ and the brain, must be promptly anticipated. Perfect rest in a darkened room, with local blood-letting, blistering, and the administration of calomel and opium, constitute the principal preventive measures. Antimony or anything likely to produce sickness must be avoided, and also active purgation; the efforts of straining in vomiting or defecation affect the eye unfavourably, and peril prolapsus of the iris.

This additional lesion having occurred; the iris may be reduced by very gently rubbing the lid against the cornea, over the prolapsed portion, aided by a drop or two of solution of atropine let fall into the eye. This will also be the best precaution against the occurrence or the recurrence of prolapsus, by ensuring dilatation of the pupil. Strangulation of an unreduced prolapsus soon supervenes, rendering reduction impossible. If prolapsus of the iris cannot be reduced, whether in the first instance, or owing to strangulation; the protruding portion may be snipped off with fine curved scissors to prevent any irritation of the eye by its presence, but the removal of this portion of the iris endangers further protrusion. Hence, a large prolapsus may require excision; otherwise it had better be allowed to remain, and the projection will probably disappear spontaneously. The iris plugs up the aperture at the level of the cornea, and cicatrization rapidly ensues, leaving a somewhat opaque scar. Any application of nitrate of silver is unnecessary or injurious.

Adhesions of the iris may, perhaps, be prevented by the anti-inflammatory measures above indicated, especially by calomel and opium.

Opacity of the lens or its capsule, forming traumatic cataract, may eventually necessitate an operation for its extraction.

Disorganization of the eyeball, by or in consequence of a penetrating wound, will probably necessitate extirpation of the organ; as in the case already noticed.

*CONTUSION.*—Blows on the eye produce contusion; restricted to the eyebrows and lids, with the ordinary appearance of "black-eye," or involving the eyeball, with peculiar appearances.



*Black-eye* consists of an extravasation of blood into the subcutaneous cellular tissue of the eyelids; presenting the usual discoloration of ecchymosis, and undergoing various shades of colour from black to green and yellow, as it disappears. The subconjunctival texture is likewise infiltrated. Concussion of the retina sometimes accompanies this palpebral lesion, followed by loss of sight, temporarily or permanently.

Contusion of the *eyeball* presents the appearances of blood extravasated into the chambers of the eye, and especially into the anterior chamber, partly or wholly concealing the iris and pupil. Extravasation may here also undergo absorption, in a period varying from a week or two to some months, according to the suppression of inflammation.

*Rupture* of the eyeball, produced by a blow, is always a very serious injury; comprising escape of the aqueous humour, with perhaps detachment of the iris, or dislocation of the crystalline lens forwards into the anterior chamber or backward into the vitreous humour. Sometimes, this humour escapes, and the globe of the eye collapses. Intense inflammation follows any rupturing injury.

The *treatment* of contusion varies with the damage done. An ordinary black-eye may be left to itself, or the disfigurement chased away by arnica lotion. The mouse's-back bruise produced by the pounding fist of a prize-fighter, has, I believe, been removed by puncturing and sucking out the blood. Contusion involving the eyeball must be promptly met by measures preventive of inflammation; while rupture of the ball usually requires some kind of operative interference. Thus, an artificial pupil may have to be made, or displacement of the lens rectified. Collapsing rupture will probably require, or lead to the necessity of extirpation of the remnant organ.

**FOREIGN BODIES.**—Various kinds of foreign bodies are apt to enter the eye; a grain of sand or particle of brick or mortar, lime, flint, shot; or other matter to which the eye may perchance be exposed by occupation, amusement, accident, or in the event of malicious intent. Such bodies lodge commonly in the conjunctiva, and under either lid; occasionally they are impacted in the cornea, or penetrate deeply into the eye.

The exposed part of the eye can readily be inspected; the inside of the lower lid and lower part of the globe, simply by depressing the lid with the finger, so as to evert the lid, while the patient is desired to look up; or the upper lid and corresponding part of the globe can be examined by raising the lid as the person looks downwards. To completely inspect this lid, it is necessary to evert it; a little procedure easily accomplished by laying a probe across the globe of the eye at the back of the lid, then taking the eyelashes between the finger and thumb and turning the lid upwards over the probe, thus exposing the palpebral cartilage. Sometimes, however, the eye is shut forcibly and screwed up, by the pain of irritation, or timidity of the patient; and eversion cannot be at once effected.

*Treatment.*—Removal of a foreign body from the conjunctiva, may generally be accomplished by a light touch with a probe or fine scoop, the hand resting steadily on the cheek; or a camel's-hair brush may be employed more effectually, and the eye swept round to remove more than one particle. In the Welsh iron-mining districts, the workmen have a knack of skilfully licking out a particle of iron from the eye; a nasty mode of performing a nice ophthalmic operation, but it answers well, and the tongue-brush is always ready for any emergency. Powder, of any

kind, must be syringed out with water ; and lime may at the same time be neutralized by thus applying weak vinegar-and-water.

Abrasion of the conjunctiva sometimes occurs, without the presence of a foreign body, as by the scratch of a finger-nail ; and any such injury will occasion more pain, if less irritation, than a rough particle in the eye. A drop of castor oil, is, according to Mr. Bowman's experience, the most soothing application.

It should be remembered, that after the removal of a foreign body from the eye, the sensation of its presence remains for some time, with continued redness of the conjunctiva and lachrymation. This sensation is sympathetic, and practically misleading.

Impacted and penetrating foreign bodies must be extracted as soon as possible.

Inflammation subsides, in many cases, after removal of the cause, but it must be subdued should it continue.

#### DISEASES.

DISEASES OF THE EYELIDS.—(1) *Hordeolum*, or *Stye*.—A minute boil, beginning at the edge of the lid, as a small, red, hard swelling, accompanied with itching and a sense of stiffness. The whole lid may become involved, and the eye closed. Matter forms and discharges from the summit of the boil, a small slough of cellular texture escapes, and the red swelling subsides and disappears. Sometimes, this furuncular inflammation remains indolent, without suppuration.

Weak and scrofulous children are most subject to this affection ; adults far less commonly.

*Treatment* consists in warm fomentations or poultices, until pointing occurs ; with tonics, attention to the bowels and diet. Indolent stye may advantageously be touched with nitrate of silver.

(2) *Abscess in the Meibomian follicles*.—An obstructed follicle, containing retained secretion, forms a minute, solid, granule, which irritates the eye. Abscess of the follicle follows. The lower lid is commonly affected.

The *treatment* is simply a puncture and evulsion of the small nodule of stearine by means of a scoop ; then the irritation subsides.

(3) *Ophthalmia tarsi*.—Inflammation at the roots of the eyelashes, forming minute pustules, which, discharging, encrusts and mats the eyelashes together, and gums the eyelids during sleep. The hairs become misplaced and inverted, constituting the state named *trichiasis* ; or the hair-bulbs are destroyed, and the hairs shed, leaving the margins of the lids ulcerated and raw, or rounded into a smooth, red, shining cicatrix, having neither hairs nor meibomian orifices. Superadded to this state, the puncta may be obliterated, the tears running over the cheeks, causing irritability and blinking of the lids, and thus constituting the condition properly named *lippitudo*.

*Treatment*.—Any accumulation of crusts must be carefully washed off night and morning, in order to remove this source of irritation, and to make applications to the minute sores at the roots of the hairs. For this twofold purpose, also, they may be kept closely cut with scissors. Stimulating ointments should then be applied, such as the diluted ung. hydrarg. nitratis, by a small camel's-hair brush. Lotions are useful adjuncts—*e.g.*, the acetate of lead, from two to four grains in the ounce of distilled water. With *ulceration*, the hairs should be plucked out. *Lippitudo* may be

much relieved by slitting up the canaliculi. The general treatment throughout must be tonic, and have special regard to the state of the digestive organs.

(4) *Trichiasis* is an irregular growth of the eyelashes, the general form of the eyelid remaining unaltered, and the ciliary misplacement arising from any cause. A single hair, or several, may be affected, with proportionate irritation and a constantly watery state of the eye.

The *treatment* is simple, and often effectual. The offending hair or hairs must be removed; a single hair, by forceps with a slow, steady pull so as not to snap it and leave the root; or several hairs may be removed by dissecting out the small portion of lid, external to the tarsal cartilage, in which their roots are implanted, and uniting the wound with a suture.

(5) *Entropion*.—An *inversion* of the lids, as distinguished from *trichiasis*, which is a displacement, chiefly by in-growth, of the eyelashes. But the two conditions are frequently associated. Both occasion the same symptoms of irritation of the eye, and are aggravated by their concurrence. Entropion arises from various causes, and thus presents certain special and incidental symptoms. Spasm of the orbicularis palpebrarum muscle in the irritable ophthalmia of children, is the simplest form of entropion, and as affecting the lower lid; a similar spasmodic inversion happens in the relaxed lower lid of old persons. Chronic inflammation of the palpebral conjunctiva occasions a far more severe and obstinate entropion, the upper tarsal cartilage curving upon itself, until the whole range of eyelashes turns backwards against the globe. Contraction of the conjunctiva, consequent on prolonged stimulation by nitrate of silver or sulphate of copper, or cicatrization following injury from acids, caustic alkalies, or burns; are occasional causes.

*Treatment* must of course have reference to any cause in operation. Various procedures have been devised to counteract the resulting inversion. *Excision* of an elliptical portion of the skin of the lid, together with the subjacent fasciculus of muscle, and then uniting with fine sutures; may effect a cure in a flaccid lid, subject to spasmodic inversion. Care should be taken lest, by removing too large a portion of skin, an opposite state, eversion of the lid, be produced. An *extreme* degree of inversion, by incurvation of the tarsal cartilage, may be overcome by Mr. Streetfeild's expedient. The skin of the lid having been dissected up, a long, narrow, wedge-shaped slice is excised from the tarsal cartilage, forming a groove extending the whole length of the tarsus. Excursion is thus produced, and the flap of skin being replaced is united with sutures.

Trichiasis may require removal of the eyelashes, with the portion of tarsal margin containing their roots.

(6) *Ectropion*—*eversion* of the lids, is the opposite condition to entropion. The appearance of the inner surface of the lids—the conjunctiva, red, swollen, and discharging, will be readily recognised. Eversion arises either from chronic thickening of the palpebral conjunctiva, which presents granular excrescences—the state known as *granular lids*; or, from contraction of the skin, by cicatrization, as after a burn on the cheek.

*Treatment*, here also, must have reference to the cause in operation, and to the resulting deformity. Thickening of the conjunctiva may be reduced by the moderate application of nitrate of silver, or diluted ung. hydrarg. nitratis, diluted ung. hydr. nitrico-oxydi, or diluted ung. zinci oxydi. This failing, a portion of the palpebral conjunctiva must be excised, that the lid may be restored to position by contraction; and it



may be necessary to remove also a wedge-shaped piece of the tarsal cartilage. An everting cicatrix of the eyelid is best remedied by the transplantation or transposition of a portion of adjoining healthy skin.

(7) *Epicanthus*.—A crescentic fold of redundant skin at the inner corner of each eye, partly or wholly concealing the caruncle. Associated with a depression of the nasal bones, the face has a laterally stretched, Chinese expression. This disappears somewhat, as, in after life, the bridge of the nose rises, and carries up the fold of integument.

The only cure is by pinching up a vertical fold of skin between the eyebrows, removing it, and uniting with sutures.

(8) *Union of the Lids*—*Ancyloblepharon*.—This state may be partial, and resulting from ulceration, or complete and congenital.

Division of the junction, and separation of the lids, will sometimes prove successful.

(9) *Union of the Lids to the Globe*—*Synblepharon*.—This state also may be more or less complete, but it is, I believe, always of traumatic origin; the adhesions resulting from destruction of the opposed surfaces of conjunctiva, as by quick-lime injury or a burn. One of the worst cases I ever saw, was owing to an accidental thrust in the eye with a hot poker.

Division of the adhesions and separation of the surfaces, is the only mode of cure. But union is apt to return, to obviate which, Mr. Walton divides the band vertically, through its entire thickness, and brings the edges of each side severally together by sutures.

(10) *Hare Eye*—*Lagophthalmos*—is an open state of the eye, arising from various causes. Structural conditions, as the contraction of a cicatrix, resemble ectropion; and are amenable to the same treatment. Paralysis of the orbicularis muscle, from various conditions affecting the facial trunk of the seventh nerve or portio dura, allows the levator palpebræ to act unopposed, and thus keeps the eye open. Exposure to cold may have this paralyzing effect temporarily; or it may depend on some more centric and permanent cause, as a tumour in the course of the nerve, disease of the petrous portion of the temporal bone transmitting the nerve, or upon congestion of the brain.

The treatment will be guided entirely by the apparent cause. Temporary paralysis may be relieved by derivation—a blister behind the ear.

(11) *Ptoſis* is a drooping of the upper lid, owing to paralysis of the third, or motor-oculi, nerve; the eye itself is abducted, the pupil dilated and fixed, and vision somewhat impaired. The eyelid is smooth and unwrinkled, and the forehead furrowed by the frequent action of the occipito-frontalis muscle, in attempting thus to raise the lid. Head-ache, giddiness, and other cerebral symptoms, may denote congestion of the brain as the cause; or ptoſis may be symptomatic of general debility.

*Congenital* ptoſis sometimes occurs, and then, probably, the levator palpebræ muscle is altogether wanting.

The treatment of ordinary ptoſis must be directed to the removal of cerebral congestion, by derivation and purgatives, followed by stimulants and tonics; or, when depending on general debility, the latter kind of remedial measures will be alone appropriate. Ptoſis, otherwise incurable, may perhaps be remedied by an operative procedure—removal of a portion of skin from near the eyebrow, in order that the lid may be subject to the elevating action of the occipito-frontalis muscle. This should not

he had recourse to when double vision would be established by the abducted state of the eye.

(12) *Spasmodic twitching* of the orbicularis muscle is accompanied with a visible quivering of the skin of the eyelid, known as *live-blood*. Either lid may be affected, commonly the lower one. It appears to be symptomatic of intestinal irritation, especially by ascarides.

*Treatment* will chiefly consist in the administration of purgatives and tonics.

(13) *Hysterical Affection of the Eyelids* is characterized by sudden and acute paroxysms of pain in the lids and eyes, aggravated by slight pressure, and occurring in girls or young women otherwise subject to hysteria. I have not met with any notice of this affection in books, but I have seen a well-marked case in a young lady, who also suddenly—in two days—lost the sight of her right eye, and so completely that she could only discern the glimmering of a strong light with that eye. The organ itself was not diseased in any way; although carefully examined with the ophthalmoscope, no change could be detected. Menstruation was healthy.

Chloroform seemed to me likely to prove the readiest means of subduing the paroxysms in this case; and having administered it on one such occasion which I happened to witness, the pain ceased, but returned as the anæsthetic influence passed off; on renewing it, the pain again subsided, and the patient slept the remainder of the night. Next morning, she was as well as ever; the amaurosis remaining.

(14) *Morbid Growths or Tumours of the Lids*.—The same tumours as in other parts of the body, are liable to occur in the eyelids, only on a smaller scale. Thus may be enumerated, more particularly; cysts, enlarged sebaceous follicles, warts, nævi, and cancer including the epithelial variety. The pathology of these growths, as affecting the lids, scarcely requires any special notice, and particulars of this kind will be found in works on Ophthalmic Surgery.

The *treatment* is not peculiar; growths situated in the eyelids must be removed, either by careful dissection, or by fine ligature.

*Lice*,—phthirius or crab-lice, as distinct from pediculi of the scalp—sometimes lodge about the roots of the eyelashes. They occasion an intolerable itching, and the lashes present a powdery appearance, clogging the roots with yellowish-grey and brown crusts, so as to resemble ophthalmia tarsi. But the movements of the insects may be detected.

White precipitate ointment, — ung. hydrarg. ammonio-chloridi—smeared into the roots of the eyelashes, will soon destroy the enemy.

DISEASES OF THE LACHRYMAL APPARATUS.—This appendage to the Eye consists; of the lachrymal gland, situated within the outer angle of the orbit, which secretes the tears to moisten the eye; the puncta and canaliculi, situated at the inner angle of the eye, which drain away any superfluous fluid into the adjoining lachrymal sac, as a temporary receptacle, and of the lachrymo nasal canal or duct, which conveys such fluid into the lower meatus of the nose.

(1) *The Lachrymal gland*.—This small almond-shaped body is rarely the seat of injury or disease. Sheltered, in a recess, within the outer angular process of the frontal bone, the lachrymal gland is not exposed to violence; and it seldom participates in the inflammation of neighbouring tissues, nor seems subject to disease commencing in its structure.

Inflammation, acute and chronic, and growths, simple and malignant, are described by some writers, especially foreign authors.

The *ducts* of the lachrymal gland are liable to become obstructed, forming a small cyst-like tumour in the upper eyelid—*dacryops*, which is plainly seen when the lid is everted. Puncture of the cyst is apt to be followed by a minute fistulous aperture in the skin, through which the secretion continually distils. This *dacryops fistulosus* may be remedied, by passing a thread through the opening and thickness of the lid, bringing it out at the conjunctival surface. A knot having been made at one end, this end is drawn into the fistula, and by continued traction of the other end, the knot is made to ulcerate its way through the conjunctival surface. The tears thus being diverted, the fistulous aperture may be closed by paring and uniting its edges.

*Tumour* of the gland presents a lobulated enlargement at the outer angle of the orbit. Extirpation is the only remedy. This operation may also have to be performed to overcome the inconvenience of an overflow of tears, when the puncta and canaliculi, at the inner angle of the eye, have been wholly destroyed by an extensive burn. In three such cases, Mr. Dixon has extirpated the gland; and these are the only instances of this operation which have fallen within his experience. The gland has been removed with the eye; and sometimes it has been involved in the disease of this organ, but more frequently found in a healthy state.

(2) *Lachrymal Obstructions*.—The puncta, canaliculi, the lachrymal sac, and the nasal duct, are severally liable to become the seat of obstruction; and far more frequently than the excretory ducts of the gland itself. Thickening of the delicate lining mucous membrane, would seem to be the cause of obstruction, in each of these portions of the lachrymal excretory apparatus.

*Epiphora* is an overflow of tears, and may therefore be symptomatic of any lachrymal obstruction on the nasal side. Obstruction of the *puncta* or of the *canaliculi* will be attended with a complete overflow; none of the secretion finding its way into the sac. Obstruction of the *nasal duct*, by stricture, necessitates an accumulation of the tears and mucus, within the sac; forming a swelling—*mucocoele*, just below the inner angle of the eye. The distended sac becomes inflamed and suppurates, forming an abscess; and this at length discharges itself through an opening in the skin, constituting *fistula lachrymalis*.

The appearances of these transitional states are too obvious to need description. The fistulous opening is generally beset with fungus granulations, owing to the constant irritation of the trickling discharge. Further destruction of the surrounding skin, or even of the bony casement of the sac, sometimes occurs. Or, the fistulous opening contracts to a small pin-hole aperture, resembling one of the puncta.

*Treatment*.—The cause of obstruction must be removed, and for this purpose, its seat must be reached. Inflammatory thickening of the membrane lining the sac and nasal canal, may be lessened by small oval blisters applied over the sac. Astringent lotions of alum or tannin dropped into the eye, pass through the puncta to the thickened membrane. Acute inflammation should be met by warm fomentations and water dressing; and when abscess has supervened, an incision must be made into the sac and the pus evacuated. The general health should be attended to, according to its condition in the course of the case. Tonics will generally be indicated.



*Operative removal of the obstruction.*—The proceeding which will be appropriate, varies with the seat of obstruction.

The *puncta* may be contracted; and then, Mr. Bowman recommends that one of them should be cut across close to the obstruction, and the *canaliculus* slit up on a fine probe. When the *canaliculus* is the seat of contraction, the sac may be punctured below the *tendo-oculi*, and the canal slit up on a fine probe run into it from the sac up to the point of obstruction. The *tendo-oculi* is easily found as it crosses the sac, by pressing with the point of the finger on the inner side, and thus putting the tendon on the stretch. *Displacement* of the *puncta*, resulting from thickening of the conjunctiva by chronic inflammation, is to be remedied in another way. Mr. Bowman slits up the canal from the punctum to a spot where it can catch the tears before they overflow the margin of the lid. After either of these operations, the probe must be introduced for several days to prevent closure of the wound.

The *lachrymal sac* and *nasal duct* are, perhaps, more commonly the seat of obstruction, by thickening of the lining membrane forming stricture. The last mentioned operation—that of slitting up a *canaliculus* from the punctum, affords a ready entrance to this portion of the lachrymal excretory apparatus. The tarsus being put on the stretch, a probe of sufficient thickness is introduced—best by the Surgeon standing *behind* the patient—and passed along the opened *canaliculus*, until its extremity strikes against the inner wall of the sac. Then, keeping it there, the probe is raised to a vertical position, and carefully slid downwards to the seat of stricture; observing to take the direction of the canal, somewhat backwards and outwards. The instrument is thus passed into the nasal cavity, and on withdrawing it, the contents of the sac may be pressed down into the nose, or after any temporary swelling has been reduced by fomentation. This proceeding must be repeated from time to time, until a cure is effected; just as in the treatment of stricture of the urethra by gradual dilatation. There is this, however, important difference; that, as the lachrymo-nasal duct is ensheathed in a bony canal, thickening of its lining mucous membrane takes place concentrically; any undue violence therefore, would only increase the inflammatory thickening, instead of lessening the stricture.

The introduction of a *style* (Fig. 323) through the sac and allowing it to remain in the nasal canal, is another mode of treatment. The transverse tendinous cord being put on the stretch, a narrow, straight, sharp-

FIG. 323. pointed bistoury, is entered perpendicularly, below the cord, into the sac (Fig. 324); and then the style may be conveniently slid along the blade through the sac, into the nasal duct, leaving the black-button head of the style over the puncture. The object of this procedure is to maintain the passage, and enable the tears to glide down between the solid

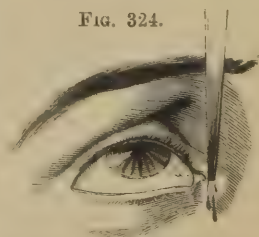
style and the lining membrane, into the nose. But the consequent irritation and return of stricture when the use of this instrument was discontinued, has led to its disuse comparatively. This mode of treatment was analogous to the cure of strictured urethra by suppur-  


FIG. 324.

*Dacryoliths*.—Concretions, by deposition of the earthy salts of the tears, sometimes form in the canaliculi or in the sac. This occasion of obstruction, is also attended with the constant overflow of tears, swelling in the situation of obstruction, inflammation, and perhaps suppuration.

The introduction of a probe into the canaliculus, or thence into the sac, will detect the presence of the concretion; which must then be removed by an incision, a scoop being used to extract the foreign body.

A *detached eyelash* sometimes intrudes into one of the canaliculi; its point protruding irritates the caruncle and semilunar fold; or it may almost escape detection.

Removal of the hair with a fine forceps, will at once terminate this inconvenience.

**DISEASES OF THE CONJUNCTIVA.**—(1) **CONJUNCTIVITIS, OR OPHTHALMIA.**—Inflammation of the conjunctiva, originating in this membrane, presents certain characteristic appearances; and whereby it can be distinguished from inflammation of the sclerotic coat of the eye itself, or scleritis—a very important diagnosis.

*Symptoms.*—Conjunctivitis is denoted by bright scarlet redness of the conjunctiva; most apparent on the inner surface of the lids and junction around the sclerotic coat of the eye, but shading off as it approaches the cornea; and this redness consists of a network of the conjunctival vessels, which are plainly seen owing to their open arrangement and large size. On the other hand, the redness of scleritis is most marked around the edge of the cornea, in the form of a dusky pink zone—sclerotic zone, shading off as it disappears backwards beneath the fibrous expansion of the recti muscles; and this zonular redness is simply a uniform tint without visible anastomosis, the sclerotic vessels being closely set together and of smaller size. Sclerotic redness is characteristic of several forms of disease in the deep-seated tissues of the eye; and therefore the twofold distinctive features of its situation and the vascularity, as compared with conjunctivitis, should be carefully noted by the student and observed in practice. The additional symptoms of conjunctivitis are, smarting, heat, weight, and stiffness in the lids, and as the disease advances, a sensation as if a grain of sand were rubbing between them and the globe. There is a more or less abundant flow of tears or lachrymation, particularly on exposure of the eye, and some intolerance of light.

The *causes* of this simple and typical form of the disease may be;—slight local irritation, as by an inverted eyelash or other small foreign body in the eye, or exposure to cold and damp; disorder of the digestive organs and general debility. March winds and dyspepsia co-operating, frequently give rise to ordinary conjunctivitis.

*Treatment.*—The removal of any source of local irritation must, of course, be primarily attended to. Remedial measures should then have reference to the state of the inflammation, and of the general health. Topical bleeding, by a leech or two or cupping to the temple, will rarely be necessary; derivation by blistering, and weak astringent lotions or eye-washes, are generally appropriate. The liquor plumbi diacetatis, fifteen minims to the ounce of distilled water, forms a useful collyrium. Spermaceti ointment may be smeared on the eyelashes at bed-time, when there is any tendency to gumming of the lids during sleep. The general treatment should not be of a lowering character; active purgation will rarely be requisite, but regulation of the bowels and the correction of any error of diet, constitute the plan of treatment. Thus, a stomach mixture,

consisting of bicarbonate of potash, the diluted hydrocyanic acid, with the tinctures of gentian and rhubarb, may often be prescribed with great benefit; combined with plain nutritious food. Tonics will often have to be resorted to; quinine and iron or the mineral acids

*Varieties of conjunctivitis are worthy of differential notice.*

(a) *Catarrhal Ophthalmia*.—A peculiar characteristic of this variety—observes Mr. Dixon—is the existence of numerous red blotches at different parts of the network of vessels, produced by some of these having given way and allowed their blood to become extravasated. The extravasations vary much in size; some being as small as a pin's head, others almost equal the breadth of the cornea. Mucous secretion, little at first, may subsequently become so profuse as to resemble another variety of Ophthalmia,—the *purulent*. Sometimes, the sclerotic is involved, as denoted by a pink zone at the margin of the cornea; and, the subconjunctival cellular tissue becoming infiltrated, the conjunctival membrane is raised over the sclerotic into a bleb containing serous fluid, an appearance which ceases abruptly at the margin of the cornea. This elevated condition of the inflamed conjunctiva, is named *Chemosis*. The upper eyelid also frequently becomes œdematous, and overhangs the lower lid,—in this mixed state of conjunctival and sclerotic inflammation.

*Treatment*.—The unmixed state of inflammation,—when the conjunctiva alone is affected, and without constitutional disturbance, requires no further treatment than the local application of nitrate of silver in solution,—two grains to the ounce of distilled water, which should be dropped into the eye, twice or thrice a day. Previously to using the drops, the conjunctiva should be cleansed with warm water. This being continued for a week, it may then be used once a day, for perhaps a week longer, when the cure will be complete. If the sclerotic and perhaps the cornea have become implicated; nitrate of silver must be omitted, and the inflammation treated as when these textures of the eye are alone affected.

(b) *Pustular Ophthalmia* is characterized by little, reddish, aphthous-like elevations on the conjunctiva, having whitish centres, but not containing pus; and each surrounded by a plexus of blood-vessels. The cornea is never involved. This variety of ophthalmia frequently occurs, particularly in children.

The *Treatment* is not peculiar; a blister to the temple, and weak astringent lotions of diacetate of lead, generally prove sufficient; the constitutional health being attended to.

(c) *Purulent Ophthalmia*.—In this variety of the disease, the *cornea* is very liable to become involved; thus constituting its distinctive peculiarity. Three sub-varieties are recognised; purulent ophthalmia, as it occurs in *adults*, in *new-born infants*, and that of *gonorrhœal* origin. But, they all agree in implicating the cornea, and also often resemble each other so closely, as not to be distinguished otherwise than by their respective origins.

Purulent ophthalmia, in a well marked state, presents the following appearances. The lids are dull red or purple, swollen and œdematous; when drawn apart, thick yellow purulent secretion oozes out from the conjunctiva, and if allowed to dry, forms a crust, concealing the eyelashes. The patient cannot open his heavy eyelids, and is pale and depressed, the more so with the belief that he is blind. Chemosis exists to such a degree as to overlap the cornea, and ulceration or sloughing of the cornea supervenes. The former commences at the extreme margin of



the cornea, underneath the overlapping chemosis, and might therefore escape observation; extending as a deep crescentic groove, perforation ensues, and prolapsus of the iris, which appears as a small dark nodule at the bottom of the ulcer, with some collateral deformity of the pupil. Sometimes, the ulcerative groove extending around the cornea, isolates its central portion which bulges as a whitish or opaque shield; or becoming thinned it is darkened by mixed fibres of the protruding iris. Sloughing of the cornea is preceded by yellowish opacity and dulness of the surface, the cornea having the appearance of wash-leather; softening and shreddy disintegration of the cornea ensues, the whole iris bulges with it, and with fibrous exudation, constitutes a *staphyloma*.

Purulent ophthalmia is communicable by contact with the purulent secretion,—it is a contagious disease. It is most common in hot climates, hence named Egyptian Ophthalmia; and I often saw the disease at Constantinople, during the Crimean War. It also occurs most frequently in this country during the hottest months,—July and August, particularly during the prevalence of an east wind. Dust irritating the conjunctiva is a predisposing cause.

*Treatment*.—Arrest of the purulent inflammation, in time to prevent ulceration or sloughing of the cornea, is the grand indication. Local measures consist in the frequent use of astringent lotions; nitrate of silver, three or four grains to the ounce of water; or alum, in the proportion of eight or ten grains to the ounce. These eye-washes may be applied by sponging or syringing, three or four times a day. Ulceration itself can sometimes be arrested by touching the spot with a fine pencil of nitrate of silver or probe coated with the fused salt.

Chemosis, having formed, threatens destruction of the cornea, apparently by strangulation of the surrounding sclerotic vessels. Tension must, therefore, be at once relieved. This is accomplished by incising the swollen conjunctiva, from the cornea to its palpebral reflection, on either side of the eye; care being taken in using a small curved bistoury, not to wound the sclerotic coat. Warm fomentations will aid the bleeding and discharge. The general treatment equally has in view the liability to ulcerative destruction of the eye, especially in a weak debilitated subject, whose power of assimilation has already failed. Tonics and a nutritious diet, are, therefore, far more appropriate than any depletory measures. Opiates may be combined with advantage to allay the irritability of weakness.

*Purulent Ophthalmia, in new-born infants*.—*Ophthalmia neonatorum*, commences within a few days of birth, usually about the third day. The symptoms much resemble those of the disease in adults. The tumid overhanging upper lids is a conspicuous feature; and on the slightest pressure, a pea-like drop of thick, yellow pus starts out from the inner canthus. Ulceration and sloughing of the cornea are equally imminent.

The *cause* of this disease in new-born infants is the contact of some morbid discharge from the mother, at the time of birth. Possibly, this discharge may be of a gonorrhœal character; but leucorrhœa would seem to be another source of contagion.

*Treatment* is precisely similar to that of the disease in adults. All antiphlogistic measures must be carefully avoided; a moderate strength of astringent eye-washes, diligently used, with tonics, as a few drops of Battley's liquor cinchonæ, and a free suckling of the child, constitute the plan of treatment whereby destruction of the eye may be prevented.

(d) *Gonorrhœal Ophthalmia* is essentially the same in its symptoms as those of ordinary purulent ophthalmia; but it differs in being far more severe and destructive, and in its origin. It is caused by the application of gonorrhœal matter from the urethra to the eye. Both eyes are often affected, and usually at an interval of a few days; the eye attacked last generally suffering least. The presence of gonorrhœal discharge from the penis will throw light on the diagnosis; and a patient having violent conjunctivitis but who denies having contracted any urethral discharge, should always be examined.

The *treatment* is substantially that of ordinary purulent ophthalmia, as already directed. But the measures indicated must be even more promptly applied,—more preventive. With every precaution, ulceration frequently happens; still the treatment should be pursued in the hope of retaining a small portion of the cornea, transparent, for the purpose of making an artificial pupil eventually and thus preserving even partial vision. This will be a greater boon if both eyes are affected; lest the filming opacity darken into total blindness.

(e) *Scrofulous Ophthalmia*.—This is essentially a disease of the *cornea*, the conjunctiva being only secondarily affected. One or more small whitish elevations,—*phlyctænula*, or perhaps pin-head ulcers, beset the cornea, which is otherwise hazy, with a long plexus of vessels running from the corneal margin to the morbid spot. This lash of vessels is quite diagnostic of the disease; there is some zonular redness in the sclerotic, immediately around the cornea, but no general vascularity of the conjunctiva. Great intolerance of light—*photophobia*, is another characteristic, with violent spasmodic contraction of the orbicular muscle,—closing the eyes forcibly, when any attempt is made to examine them. This symptom is often out of all proportion to the extent of corneal disease; co-existing probably with only one *phlyctænula* or ulcer and its lash of vessels, on almost a clean cornea. Lachrymation is profuse, the tears gushing out whenever the lids are the least separated; and there is often some excoriation of their margins. The patient thus habitually avoiding the light, acquires a sort of frowning and downcast look, and prominent brow, resulting from constant action of the corrugator muscles. Add to these appearances, the concomitant marks of scrofula in other parts of the body, and the picture of scrofulous ophthalmia is complete. It chiefly affects children, but may be seen in adults.

*Treatment*.—The general health is more important than the ophthalmic condition. A regimen—the very reverse probably of that which the child has undergone—must be instituted for the improvement of nutrition, and thereby arrest the disintegrative process going on in the cornea. Air, exercise, and plain nutritious food; with iron, quinine and cod-liver oil, as medicinal measures; comprise the elements of the antiscrofulous course of treatment. The bowels will have to be well regulated, as part of the treatment of the scrofulous constitution, and in consequence of the constipating influence of iron. Further particulars respecting the most eligible preparations of the medicinal agents adverted to, were noticed in the general treatment of SCROFULA. Of topical applications; a weak astringent lotion of alum, two or three grains to the ounce of water, is perhaps the most efficacious; and warm poppy-head fomentations or the vapour of laudanum will most effectually relieve the distressing intolerance of light. A green shade should be worn to shield the eyes. A small blister may be applied to the temple, and repeated in a week or ten

days; but there is little need of derivation. Spermaceti, or dilute citrine ointment, may be smeared along the edges of the lids at bed-time; in the advanced stage of the disease. Of local applications *not* to be used; Mr. Dixon especially denounces the nitrate of silver, and lead lotion whenever an ulcer exists—the carbonate of lead being precipitated and forming an insoluble white deposit in the cicatrix.

Opacity of the cornea, resulting from cicatrization, remains more or less permanently after a prolonged attack of scrofulous ophthalmia; but this result gradually wears out in after years, and at length a faint trace only may indicate the site of the cicatrix.

*Granular Conjunctiva*—is a serious consequence of purulent ophthalmia in any form, or of a long continued course of irritant applications. A thickened, and rough state of the conjunctiva is thus produced; and particularly of the palpebral conjunctiva, which, when examined, appears villous, and resembles the surface of a granulating ulcer. The villous projections are, however, the follicles and papillæ of the conjunctiva, enlarged by inflammatory deposit: and acquiring considerable solidity and hardness, they irritate the ocular conjunctiva, especially its upper half, occasioning lachrymation and blinking of the lids. By constant attrition, an opaque and vascular state of the cornea ensues, having an almost fleshy aspect—*pannus*. Granular conjunctiva, as consequent on purulent ophthalmia, is common among the more destitute Irish population.

*Treatment*.—Remedial measures have for their object the removal of the granular state of the conjunctiva. The palpebral conjunctiva has been subjected to the rapid action of escharotics, as by the free application of nitrate of silver; or removed, by paring it with a fine knife or scissors. The best applications are; the acetate of lead in fine powder, dusted over the everted lid, which acts probably as an astringent; or the undiluted liquor potassæ dabbed on the everted lid, may be a more effectual application, probably by chemically saponifying and dissolving the granular-hypertrophied tissue. Repeated at intervals of a few days, for six or seven weeks; the granulations will probably disappear, and the transparency of the cornea be considerably restored. Counter-irritation, by means of small blisters on the temple, or the tincture of iodine painted over the skin of the lids, seems to aid this result. In obstinate and otherwise intractable cases, it has been proposed to resort to *inoculation*, for the reproduction of purulent ophthalmia—by applying to the conjunctiva the purulent secretion from the eye of a patient suffering under the acute form of that disease. This desperate remedy has sometimes produced a perforating ulcer of the cornea; but sometimes considerable clearing of an opaque cornea, without any ulceration. It seems reasonable, therefore, to reserve this resource to the last. The general treatment is always most important; tonics and a nutritious diet have a constitutionally curative influence, without which any local measures are powerless.

(2) Certain GROWTHS of the conjunctiva, require notice.—*Pterygium* is a reddish, fleshy, fibrous growth of the conjunctiva, of a triangular shape; extending, base inwards, from the semilunar fold at the inner canthus to the cornea, or beyond its margin.

It occurs mostly in persons who have lived in hot climates, and exposure to dust may be an exciting cause.

The *treatment* is excision. The lids being held apart with a spring speculum, the growth should be seized with tenaculum forceps, close to



the cornea, and dissected carefully off the sclerotic towards the inner canthus; avoiding the caruncle and semilunar fold. Any small portion remaining on the cornea had better not be meddled with, although as obstructing the vision, its removal is all-important. But it will probably wither and disappear. If removed by operation, this portion of the pterygium can be more safely excised by a small pair of curved scissors.

*Pinguecula*, signifies small yellowish elevations on the sclerotic, close to the margin of the cornea. Supposed to be fatty, they consist chiefly of fibrous tissue. They form after the middle period of life, and especially in persons who have been much exposed to the weather, or have lived in hot climates.

These little masses are quite harmless, and had better be left alone.

*Tumours*, such as occur in other parts of the body, may also spring from the conjunctiva. Warty and polypoid growths occasionally arise from this membrane. Early excision, is the only remedy. Fatty tumour sometimes forms *under* the conjunctiva, in the sub-conjunctival tissue. Mr. Dixon has seen a few such cases, in children; the tumours all occupied the same position—the line of reflection of the conjunctiva from the lower lid to the globe. They extended from near the lower edge of the cornea to the outer canthus, were elongated in shape, almost like a haricot bean, and partly concealed by the lower lid. An incision through the conjunctiva and fibrous capsule of the tumour, readily allowed the fatty mass to be turned out.

*Cysticercus telæ cellulosa*.—This parasite is found, very rarely, in the sub-conjunctival cellular tissue. It appears as a rounded body, about the size of a pea; situated midway between the inner canthus and cornea in two instances. A slight incision lets this body slip out. Its nature will be shown by examination under the microscope.

*Stains from Nitrate of Silver*.—A dirty sepia tint of the sclerotic is apt to follow the prolonged application of nitrate of silver, as an eye-wash. In one case, Mr. Dixon found that the stain almost disappeared under the long continued application of hyposulphite of soda in solution, ten grains, gradually increased to a drachm, to the ounce of water. It is necessary to maintain the contact of the solution for some time; and this was accomplished by means of an eye-glass, the patient being ordered to draw down the lower lid and fix it against the cheek-bone with the rim of the glass, before reclining his head.

DISEASES OF THE CORNEA.—(1) CORNEITIS OR KERATITIS.—Inflammation of the cornea is denoted by crescentic vascularity, passing from the edge of the cornea for some little distance into its substance. This characteristic vascularity involves a third or half of the corneal circumference, and the constituent plexus of vessels is so fine that it appears as a small patch of blood smeared upon the surface of the cornea. An inch focus glass will, however, show the vessels composing the plexus. A zone of pink vessels in the sclerotic, surrounds the cornea; but this is present also in iritis and other deep inflammations of the eye. Conjunctival vascularity, indicative of ophthalmia, is absent. Profuse lachrymation and intolerance of light accompany corneitis, as in other affections already described. Haziness and opacity of the cornea soon supervene; eventually, softening with a yellow tint, ulceration of the cornea, and suppuration within its substance, or, the matter bursting through the cornea posteriorly sinks down to the bottom of the anterior chamber—*hypopyon*.

ensues. One eye usually suffers and then the other, perhaps as the first is recovering.

Children are most liable, and the disease rarely occurs after the age of twenty. The constitutional condition is generally weakly, and the subjects anæmic and pale. There may be marks of scrofula.

*Treatment.*—No lowering measures are tolerated. The remedial measures, local and general, so entirely resemble those of Scrofulous Ophthalmia, that any repetition is unnecessary.

*Chronic Interstitial Keratitis*—so named by Mr. Hutchinson, has been shown by him to be a manifestation of inherited constitutional syphilis. Presenting itself in children and young persons from five to eighteen years of age, this form of corneitis may be recognised by the following appearances. It begins at the centre of one cornea, as a diffused haziness like that of ground glass. Whitish dots soon beset this haze, forming in the very substance of the cornea. Coalescing, they increase the central opacity. A fine plexus of vessels now overspreads the cornea, deeply pervading the opaque portion; and especially affecting the upper and central part, rather than the lower half, of the cornea. There is no tendency to ulceration. Subsequently, in about two months or earlier, the other cornea undergoes the same form of opacity and vascularity, in like manner.

*Diagnosis.*—The vascularity will be observed to differ from the lash of vessels in scrofulous ophthalmia, and from the superficial crescentic plexus of ordinary corneitis. Other marks of hereditary constitutional syphilis accompany this affection of the cornea, and particularly a certain characteristic vertical notching of the upper central incisor teeth.\*

The *treatment* recommended is a combined specific and tonic plan, consisting of mercurials and iodides, supported by tonics and a nutritious diet.

*Opacities of the Cornea.*—These conditions have been noticed incidentally as consequences of various affections of, or involving, the cornea. Corneal opacities are of two kinds—simple opacity, resulting from inflammatory disintegration and interstitial deposit—*e.g.*, *nebula*; and cicatricial opacity, resulting from ulceration, with loss of substance, and cicatrization—*e.g.*, *albugo*, and *leucoma*. The former state of opacity may be simple haziness, and comparatively transient; the latter is a more dense, white opacity, and probably permanent.

But the prognosis will depend very much on the age of the patient. In infancy and youth, when nutritive changes are most active, cicatrices of even large size diminish both in extent and density, until the cornea becomes almost clear in after-life.

*Treatment.*—Practically, the distinctions adverted to are most important, simple opacity being curable, cicatricial opacity incurable, by art. Any treatment can only be curative by promoting the molecular changes of absorption and nutrition. To this end, weak stimulant washes to the eye, and a generally tonic and dietetic course of treatment may contribute. The curative influence of mercurials is doubtful.

*Ulcers of the Cornea.*—The characters of these conditions have been sufficiently described in connexion with Purulent and Scrofulous Ophthalmia, and Corneitis.

*Treatment.*—Nutrition must be promoted by tonics and diet. Of local

\* Ophthalmic Hospital Reports, vol. i. 1858, and Trans. Path. Soc. vol. ix.

stimulant applications, by eye-drops or eye-washes, nitrate of silver is the most efficacious adjunct to the general treatment. Its use should not be continued too long, lest an insoluble deposit taking place in the ulcer, opacity may result. Lead-lotions, on this account, are wholly inadmissible.

*Staphyloma*.—Protrusion of the cornea, probably involving the iris, results whenever the cornea, in whole or in part, has been destroyed by injury or disease, and a cicatrix having formed, it there bulges forwards before the pressure of the humours of the globe; presenting an opaque white prominence.

*Treatment* should be directed to the arrest of such projection. Nitrate of silver applied to its apex may induce just sufficient inflammatory deposit to thicken and strengthen the yielding cornea. A small, conical, staphyloma, not involving the iris, may be shaved off; cicatrization will then, perhaps, brace up the cornea and prevent any further protrusion.

(2) *CONICAL CORNEA*.—A rare deformity, in which the cornea has become extremely convex, but retains its transparency, and gives a remarkably brilliant appearance to the eye. The conical shape of the cornea is well seen in profile. Dissection, in a few cases, has shown that the apex of the cone is very much thinned. The position and movements of the iris remain unchanged, and the other tissues of the eye unaffected. But the patient—usually between twenty and thirty—grows short-sighted, and at last becomes totally blind.

*Treatment*.—All kinds of operative measures and eye-washes have been tried and failed. The only relief has been found in compensating optical contrivances. Deeply-concave glasses enable the patient to see, in slight cases. A small, pin-hole aperture, in a blackened shield, or metallic plate, held close to the eye, will enable a patient to read at a focus of five or six inches, who could not otherwise discern a letter. Or, a slit, about three-fourths of an inch long, and the thirtieth of an inch wide, allows a considerable range of lateral vision, without moving the head. A combination of concave glasses and this perforated diaphragm, set in a spectacle frame, may prove even more advantageous.

(3) *ARCUS SENILIS*.—A circumferential opacity of the cornea, depending, as Mr. Canton has shown, on fatty degeneration. When both eyes are affected, this opacity denotes one of those naturally degenerative changes of nutrition, which the cornea, in common with other textures—especially those of low vitality—undergo as life advances, say from fifty years of age, onwards. Thus, arcus senilis is often associated with fatty degeneration of the heart. In like manner it may be indicative of premature old age. As affecting one eye, it is generally the result of previous injury or disease of the organ itself. Fortunately, this textural deterioration does not interfere with vision, nor render the texture of the cornea unfit for operation, as the extraction of cataract—the wound then uniting quickly and soundly.

No known *treatment* is of any avail.

*DISEASES OF THE SCLEROTIC*. — *SCLEROTITIS*. — Inflammation of the Sclerotic, or white coat of the eye, has been alluded to as occurring *partially*, in connexion with Catarrhal Conjunctivitis, and with Corneitis, and it also accompanies Iritis. The vascular contiguity or continuity of the textures severally affected with Inflammation, probably explains this concurrence. But Sclerotitis may occur alone, or at least as a primary affection, and more completely than when thus associated.



The whole of the sclerotic is intensely injected, the otherwise white coat assuming a pink tint, shading into violet, owing to the depth of the vessels in the fibrous tissue. Lachrymation and intolerance of light are marked symptoms; and pain deep-seated in and around the eyeball, of an aching and neuralgic character, radiating to the brow, temple, and cheek, and penetrating to the back of the head. Exacerbations occur during the night, and remit towards morning. The constitutional disturbance, also, is intense, the febrile symptoms leading to a copious deposit of lithates in the urine; hence the disease has been named *Rheumatic Ophthalmia*.

*Diagnosis* from Conjunctivitis.—The redness differs in its colour, being a pale pink, and the injected vessels run in straight lines from the circumference of the eye towards the cornea; whereas, in conjunctivitis, the colour is crimson, the vessels tortuous and anastomotic, forming an open network, which, moreover, can be moved about under the finger. The intense, deep-seated pain of scleritis, compared with the pricking sensation as of a grain of sand in the eye, will confirm the diagnosis.

*Treatment*.—A free purgation should be followed by opiates, in narcotic doses. Quinine is valuable in proportion to the neuralgic character of the pain; and colchicum with an alkali or iodide of potassium, according to the rheumatic character of the constitutional disturbance. Dover's powder is then a suitable narcotic, its sudorific influence also proving beneficial. In point of diet, sugar and sugar-forming substances are forbidden.

Local measures seem to be comparatively useless for subduing the inflammation; bleeding, by means of leeches, gives only temporary relief, and blistering aggravates the neuralgia. Steaming the eyes with warm water may afford soothing comfort, or friction of the forehead every afternoon with extract of belladonna dissolved in warm laudanum, a drachm to the ounce; or dry warmth by means of muslin bags filled with camomile flowers, heated on a plate. But perhaps the most soothing application is chloroform, diluted with olive oil, on lint, applied to the temple and forehead. The patient's room should be moderately darkened, and an eye-shade worn.

*Chronic scleritis* does not affect the whole of the sclerotic coat at once, but appears as a limited patch of redness, close to the cornea; this fading away, it reappears elsewhere, always close to the cornea. Eventually, the cornea or iris may become involved, thus inducing opacity, or a very insidious iritis.

*Treatment* consists in the same remedial measures and observance of diet, as in the acute form of scleritis; but this plan of treatment must be pursued more or less for a long time. Any tendency to opacity of the cornea, or iritis, must be checked in limine; calomel and opium being administered in small doses, while the circulation is sustained by bark and nutritious food.

**THE ANTERIOR CHAMBER.**—A living *entozoon*—the *cysticercus telæ celulosæ*, has not unfrequently been found in this situation. It is a rounded, semi-transparent, vesicular, body, having a long, retractile, neck, terminating in a head furnished with suckers and a circlet of hooks. As a foreign body, it excites inflammation of the iris and cornea, ending in total blindness. A crescentic incision along the margin of the cornea, lets out the animal with the aqueous humour. Perfect rest and protection from light should then be secured during the process of healing. A

bandage, therefore, is worn over both eyes for the first twenty-four hours, and afterwards the wounded eye should still be kept closed as the incision unites and the aqueous humour is re-secreted. Any constitutional management will be suggested by the irritability, weakness, or other state of the patient.

**DISEASES OF THE IRIS.**—(1) **IRITIS.**—Inflammation of the iris presents certain characteristic appearances—chiefly a loss of the peculiar fibrous texture of the iris, a change of colour, from dark to reddish or from blue to greenish, diminished size, and an irregular shape of the pupil, and early loss of its mobility, with a well-marked sclerotic zone around the cornea. Sometimes, the conjunctiva becoming involved, it also is injected; or the cornea appears slightly hazy. Intolerance of light is a symptom common to other ophthalmic affections; and deep-seated, radiating, and paroxysmal pain occurs, as in scleritis

Lymph is effused, producing further changes in the appearance of the iris; its surface acquires a rusty, villous or nodular aspect, adhesions take place forwards to the cornea, or backwards to the capsule of the lens. Sometimes, the pupil becomes occluded with a film of lymph, and the anterior chamber may be occupied by a more abundant effusion. The accompanying impairment of vision is proportionate in its completeness and probable permanency. But, in iritis, the *retina* is often more seriously affected than the iris itself; and this concomitant disease has been discovered by the ophthalmoscope.

*Causes.*—Iritis may have a traumatic origin, as a consequence of various injuries of the eye, or of its over-functional exertion; or the disease may be a local manifestation of various constitutional conditions—secondary syphilis, rheumatism, gout, or scrofula. One, or both eyes may be affected; in the former case by injury; in the latter, by constitutional disease. But in some such cases, both eyes are attacked simultaneously or in succession, and occasionally the disease is limited to one eye; or relapses occurring, the eyes may be affected alternately. These manifestations of constitutional disease are all illustrated by Syphilitic Iritis.

*Varieties of Iritis.*—Inflammation of the iris varies, like other diseases, in its intensity and duration, whereby it is distinguished as the *acute* and *chronic* forms of iritis. But its modifications correspond also, and more particularly, to the constitutionally-causative conditions: thence, the syphilitic, rheumatic or gouty, and scrofulous, forms of Iritis. Their symptomatic distinctions are far less definite and characteristic.

(a) *Syphilitic Iritis.*—Lymph-effusion is the most marked feature, taking place rapidly and abundantly; *nodules* of lymph are presented, of a yellow, reddish-yellow, or nearly red colour, and situated especially about the edge of the pupil, encroaching upon or even occluding the pupillary area. The cornea often remains perfectly transparent, even when the iritis is most severe. On the other hand, those symptoms which more peculiarly accompany rheumatic iritis, are absent—a generally-diffused redness of the sclerotic, and great intolerance of light.

*Diagnosis.*—But the nodular appearance of lymph is so uncertain, as to render its diagnostic value very doubtful. Thus, the lymph may be uniformly distributed around the margin of the pupil, which then assumes a thickened ring-like appearance; the rest of the iris retaining almost or altogether, its healthy aspect. Occasionally, nodules of lymph, instead of forming on the edge of the pupil, are situated on the circumference of the iris, adjoining the cornea. Other secondary syphilitic affections of

the throat or skin, are usually present with, or have preceded, the iritis. This concurrence is far more surely diagnostic.

(b) *Rheumatic Iritis*.—A general diffused redness of the sclerotic, as the most marked appearance, and great intolerance of light, with orbital radiating and neuralgic pain, are the most characteristic symptoms. The cornea is almost always hazy. But the nodular form of lymph deposit is absent, and effusion takes place so sparingly and insidiously; that the morbid changes in the iris, thus slightly marked, may escape observation, in the first instance. When the inflammation has subsided, and the cornea become clear, irremediable adhesion of the iris may then be discovered.

The disease seems plainly of rheumatic origin, and is frequently associated with other rheumatic affections.

(c) *Scrofulous Iritis*.—The ocular appearances have a general resemblance to those of syphilitic iritis; in the abundant deposit of nodular masses of yellowish lymph, but situated more frequently midway between the pupil and the circumference of the iris, or at this part. Slight hæmorrhage, not uncommonly, takes place into the anterior chamber, from bursting of the distended veins of the iris. The cornea usually remains clear.

*Treatment*.—Iritis presents certain *general* indications of treatment; irrespective of whatever form it may assume. They are; to arrest inflammatory effusion, and promote absorption of any lymph-deposit; and to prevent adhesion of the iris; also, to relieve pain. The constitutional treatment will be that of inflammatory fever.

To *arrest inflammatory effusion*; bleeding by leeches or cupping to the temple, followed by blisters, must be maintained by temporary laxative aperients and low diet. Mercury seems to have the power of arresting the effusion of lymph, far more than of inducing its *absorption*. Calomel and opium may be administered, in small doses—say a grain or two with a quarter of a grain respectively, every four or six hours; its influence on the eye being watched, rather than with the view to salivation. Other preparations of mercury, such as hydrarg. c. cretâ, may be given, in like manner. Tonics, principally quinine, and a nutritious diet, must soon replace any general lowering measures; thus to re-enforce absorption, by maintaining the circulation.

To *prevent adhesion* of the iris, posteriorly, to the capsule of the lens, or anteriorly, to the cornea; belladonna has the most powerful influence, applied topically, as a means of dilating the pupil and keeping it in that state, removed from the liability of contact. The extract may be smeared around the eye, or a solution of the extract, one scruple in an ounce of distilled water, may be dropped into the eye, occasionally. The sulphate of atropine—a grain to the ounce of water, forms a solution of greater value. Mr. Dixon regards atropine—or belladonna—as inert and useless during the acute stage of iritis; but that it may be advantageously applied when the inflammation has subsided, and the iris is beginning to regain its contractility—as the means of then ascertaining the extent of adhesion.

To *relieve pain*; steaming the eye over hot water is a most soothing application, or neuralgic orbital pain, sometimes involving the three divisions of the fifth nerve, a most severe affection, may be relieved by friction with warm laudanum to the forehead and temple.

*Syphilitic* iritis should be subjected to the same plan of treatment. But, the effusion of lymph being particularly rapid and abundant.



mercury should be pushed more freely. Turpentine was recommended by Carmichael, as a substitute for mercury, in cases of great general debility. Its efficacy is very uncertain. Iodide of potassium with bark will probably be found more suitable.

*Rheumatic* iritis, requires the administration of mercury in small doses, to check the insidious effusion of lymph; turpentine in pill, four grains thrice a day, is most effectual in subduing the iritis, when characterized by visible injection of the iris and sclerotic, without much disposition to lymph-effusion. Some more specific treatment will also be appropriate; colchicum and alkali, or iodide of potassium. The neuralgic pain must be relieved, as already directed. Blisters will probably aggravate its severity.

*Scrofulous* iritis is more specially amenable to the general treatment of other manifestations of Scrofula. Quinine, iron, and cod-liver oil, as the chief remedial measures, must be reinforced by careful regulation of the digestive organs, and a regimen—comprising pure air, daily exercise, warm clothing, and a plain nutritious diet. Local treatment is of little avail.

ADHESIONS OF THE IRIS.—*Synechia posterior*, adhesion of the uvea to the capsule of the lens; *synechia anterior*, adhesion of the iris to the cornea; and *Atresia iridis*, closure of the pupil; are three conditions resulting from prolonged iritis.

The *treatment* consists in the application of belladonna or atropine, as a safeguard against any further adhesion, thus to preserve even a partial pupil; and the administration of mercury, in small doses, for some time, after recent adhesions. Established adhesions are curable only by operation.

*Staphyloma scleroticæ* is apt to follow synechia posterior and closure of the pupil with lymph. The aqueous humour secreted in the posterior chamber, being unable to pass through the pupil to the anterior chamber, continues to accumulate behind the iris; gradually bulging the iris, it also distends the anterior portion of the sclerotic; and this yielding forms a bluish-black prominence, streaked with the widely separated whitish sclerotic fibres.

(2) CYSTS OF THE IRIS are either congenital, or the result of injury by allowing the aqueous humour to find its way between the uvea and fibrous tissue of the iris. A cyst, thus situated, might be mistaken for a cysticercus or a dislocated lens; but it is principally distinguished by having a fixed attachment. An increasing cyst destroys the whole eyeball.

The *treatment* may be that of removal; by an incision through the cornea, withdrawing the cyst and cutting it off. Or—as Mr. Walton recommends—puncturing the cyst with an iris-knife, allows it to collapse. This operation may have to be repeated.

(3) MYOSIS and MYDRIASIS—signify, respectively, a persistent contraction or dilatation of the pupil; unconnected with any apparent structural disease of the part, and arising from purely functional causes. *Contraction*, sometimes occurs in persons accustomed to examine minute objects; and the iris refusing to dilate, this state is accompanied with impairment of vision, especially in a feeble light.

Rest of the over-used organ is the obvious indication of treatment.

*Dilatation*, is liable to occur from the over-application of belladonna to the eye, or the long-continued influence of narcotics. It may be caused

also by pressure affecting the brain, as in apoplexy and compression; and it is frequently symptomatic of confirmed amaurosis. It is said to depend, occasionally, on some eccentric source of irritation, as gastric irritation. Lastly, it may be symptomatic of an affection of the nerves supplying the iris, without any loss of sensibility of the retina; and this form is, perhaps, accompanied by ptosis, as a further symptom of paralysis of the third or motor-oculi nerve.

A tonic plan of *treatment* will, generally, be appropriate. Mr. Taylor recommends *nux vomica*; and derivation by means of a succession of blisters to the temple has proved beneficial, with the application of stimulating vapour, as of ammonia, to the eye. Improvement of vision—the retina retaining its sensibility—may be aided by habitually using concave glasses.

(4) ARTIFICIAL PUPIL.—*Operations* for the admission of light through the iris are of three kinds, all of which are comprised under the term, formation of an artificial pupil. (1) The formation of a new aperture in the iris, when the portion forming the natural pupil has prolapsed through a breach in the cornea; (2) the reopening or the enlargement of the natural pupil, when obstructed by inflammatory deposit; and (3) the displacement towards a transparent part of the cornea, of a pupil which has become concealed behind a dense corneal opacity.

The following *conditions* are laid down by Mr. Dixon as essentially necessary to be observed, before having recourse to any kind of operation for artificial pupil:—*Firstly*—whether the eye perceives light; mere obliteration of a pupil will not deprive the eye of this power, provided the retina be sound. *Secondly*—the presence or absence of the lens must, as far as possible, be ascertained; and, if present, whether it is transparent or opaque. *Thirdly*—the cornea must be carefully examined, as to its degree of transparency. *Fourthly*—the state of the iris. The existence of chronic iritis would indicate a postponement of the operation until inflammation has ceased. A thickened iris, in which all trace of its peculiar fibrous texture has disappeared, is specially unfitted for operation; as it breaks away under the slightest traction, and, if cut, the wound does not gape, so as to form a permanent aperture. *Fifthly*—as a rule, when the other eye is perfect, it is undesirable to operate.

The *situation* of an artificial pupil should be made as near the centre of the iris as circumstances will allow. The size of such pupil should not be unnecessarily large. Injury to the cornea should be as restricted as possible; the cicatrix encroaching on a cornea, which already has a limited area of transparency, will still further diminish the field of vision.

The different modes of making an artificial pupil may be arranged under four heads: laceration, incision, excision, and ligature of the iris.

*Laceration* consists in tearing away a certain portion of the iris from its ciliary attachment. An incision is made near the margin of the cornea, a sharp hook introduced, and carried across to the opposite side of the anterior chamber, it is there stuck into the iris, and then drawn back towards the corneal wound; then by rupturing the ciliary attachment of the iris to the extent necessary, the hook is detached and withdrawn. This operation, has however, been denounced as “unscientific, clumsy, and ineffectual,” and one which ought to become obsolete.

*Incision* is performed by means of a cutting-needle, or with scissors. The needle is introduced close to the edge of the cornea, and carried

across the anterior chamber to a little beyond the middle of the iris; the edge is then turned backwards, and the iris divided to the requisite extent. The instrument is rotated into its original position and withdrawn. Scissors may be used for dividing the iris—as proposed by Maunoir—but their introduction necessitates a large corneal wound, and neither a linear nor V-shaped incision can be easily accomplished when the iris is flaccid, by escape of all the aqueous humour.

The principle of this mode of forming an artificial pupil consists in utilizing the elasticity of the fibres of the iris; retraction immediately following their division, and thus the formation of an artificial pupil. The probability of success will, therefore, be proportionate to the tension and the healthy retractile power of the iris. But this operative procedure is contra-indicated by a contrary state of the iris, and by the presence of the lens behind, which will almost surely be injured by a cutting instrument. Hence, the operation is restricted in its application, to cases wherein, cataract having been extracted, prolapsus iridis has followed to such an extent as entirely to obliterate the pupil, and the iris is put on the stretch by its inclusion and union with the corneal cicatrix.

*Eccision.*—An opening having been made in the cornea, a forceps, or better, the blunt hook invented by Tyrrell, is introduced into the anterior chamber, a portion of iris is seized and drawn out of the corneal wound, and then removed with scissors. This mode of operation is specially appropriate in either of three conditions;—when, after extraction, extensive prolapse of the iris has ensued, so as to nearly obliterate the pupil; when, in consequence of iritis, the whole pupillary margin has become adherent to the capsule, the peripheral portion of the lens remaining transparent; when, the iris is perfectly healthy, but the pupil is concealed by a dense central opacity of the cornea, the remainder of the cornea retaining its transparency.

*Ligature.*—A puncture is made through the cornea for the introduction of a canula-forceps, a small portion of the iris near its ciliary attachment is seized, drawn out through the wound, and tied with a very fine silk thread. This transforms the pupil into an elongated slit. If this aperture be insufficient, it may afterwards be enlarged by ligature of a second portion of the iris, so as to draw the pupil into a triangular shape.

This operation—devised by Mr. Critchett, and named *Iriddesis*—limits the size of the pupil, and is applicable to a certain number of cases; as when prolapse of the iris has occurred, involving so much of the pupillary margin in the cicatrix, that the area of the pupil is reduced to a very minute aperture; or when the whole pupil has been displaced towards the extreme edge of the cornea, and there concealed by opacity.

*After-treatment of Artificial Pupil.*—In a tolerably healthy state of iris, the various modes of operation, if skilfully performed, are attended with little hæmorrhage into the anterior chamber, or inflammatory consequences. Repose of both eyes, by means of a bandage, is necessary for two or three days, and the operated eye should then be closed for a day or two more. At the end of a week, a large eye-shade will be sufficient, and tinted glasses should be worn for some time. Any opiates, and the regulation of diet, will be suggested by the constitutional state of the patient.

DISEASES OF THE LENS AND ITS CAPSULE.—CATARACT—is an opacity of



the crystalline lens or of its capsule, or of both; partial or complete. Agreeably to this definition, cataracts have been arranged under two primary forms: (1) Capsular cataract; (2) Lenticular cataract; or a combination of both, the most common form, (3) Capsulo-lenticular cataract. *Cortical* and *Nuclear* cataracts are terms proposed by Mr. Dixon, as synonymous with the two primary forms. *Lenticular* cataract again is distinguished according to its density, into the *hard* and *soft* varieties. These terms represent only certain stages in the progress of cataract; in no form of the disease does the lens undergo progressive hardening; but the lens for a long time retaining its naturally firm consistency while opacity is advancing, undergoes disintegration and softening, thus acquiring an uniformly whitish, milky opacity; eventually, perhaps, becoming transformed into a *fluid* condition.

*Symptoms, and Signs or Appearances of Opacity.*—Subjective symptoms, or those which the subject of the disease may himself experience, are not to be relied on as positive evidence; nor need such symptoms be accepted, since they can be *tested*, in regard to any functional defects of the organ. Dimness of sight, more or less marked, uniformly involving the field of vision, coming on gradually, without inflammation, and unattended with any impairment of motor power in the iris, is a suspicious symptom; but supposed defects of visual power should be tested and proved, by the independent observation of the Surgeon.

An examination of the suspected eye, or of both eyes, must be made; first, in its natural state, and afterwards, when the pupil is dilated by a few drops of the neutral sulphate of atropine,—two grains to the ounce of distilled water. A convex glass, of an inch focus power, should be used as a condenser, to concentrate light upon the surface of the lens; the patient standing in front of a window which admits a good light,—not direct sunlight.

*Capsular* cataract presents—behind the pupil—an opaque body, of a gray dead white colour; *Lenticular* cataract, a bluish-white or amber-coloured opacity. Various shapes and shades of opacity are recognised, of subordinate importance, but some of which may be noticed in connexion with cataract in adults and infants, respectively.

*Cataract in adults.*—Usually occurring in advanced life,—after the age of fifty or sixty; the rise and progress of cataract in elderly persons are as follows:—The circumference of the lens is first affected, commonly the lower edge, in the form of opaque striæ, which gradually advance along the posterior and anterior faces of the lens towards its axis. These striæ coalesce into patches, spreading chiefly over the posterior surface of the lens. In this state, the cataract may remain stationary for a year or several years. Then, the whole body of the lens, and especially the nucleus, becomes slightly hazy; through which, however, the posterior radiated opacity can be discerned,—the eye being illuminated with concentrated light. The anterior surface becomes involved, the opaque striæ advancing from the margin, until the points come within the area of the pupil. As the central opacity acquires greater density, vision is lost, excepting to strong light and bright colours. The fibrous structure of the lens gradually disappears with increasing opacity; disintegration proceeding, a deposit of earthy and fatty matter takes place, and crystals of cholesterine just within the capsule, may be recognised by their sparkling appearance. These further changes are limited to the surface of the lens, and present a *whitish* opacity. Sometimes they do not occur, and the

cataract has a dull *brownish* appearance like horn, very difficult of detection. *Black* cataract is a rare form of lenticular opacity.

*Fluid* cataract results from softening, beginning in the superficial portion of an opake lens, and involving the whole lens, until, in the course of years, it becomes converted into a thin pulp. The nucleus resisting this change may be surrounded with a turbid pulp of disintegrated tissue; a lens in this state constituting the "*Morgagnian* cataract."

*Congenital Cataract* presents various forms of opacity; the most common is that of an opaque nucleus, while the peripheral portion remains transparent. Other forms are, a small, white, central dot on the anterior face of the lens—*central* cataract, a diffused opacity occupying nearly the whole area of the pupil when contracted. This opacity projects forward in the shape of an obtuse white cone, which appears to adhere by its base to the anterior surface of the capsule—*pyramidal* cataract; and lastly, a very faintly striated opacity of the nucleus, a rare form of congenital cataract.

*Traumatic Cataract*.—In consequence of a blow on the eyeball, or a penetrating wound of the lens, the lens may become opake; the latter injury inevitably producing cataract. Disintegration and absorption of the lens ensue; the opake capsule remains. Iritis having been caused by the injury, the pupillary margin will probably be adherent to the capsule. Thus, then, an opake white disk occupies the area of the adherent pupil; but this disk is situated much further back than the position of a full-sized lens. Sometimes, other appearances are presented.

*Dislocation of the Lens into the Anterior Chamber*.—This injury may be conveniently noticed here. It occurs as a result of external violence, such as a blow upon the eye, or a violent fall. Disease may have pre-disposed, by weakening the suspensory ligament of the lens. This body may itself have become opake, when its appearance in the anterior chamber will at once be recognised. In a transparent state, the dislocated lens is remarkable; its margin exhibits the appearance of a ring of golden light. Pain and inflammation soon supervene. Prompt removal of the lens, through a suitable opening in the cornea, is the only treatment for saving the eye.

TREATMENT OF CATARACT.—No mode of cure, otherwise than by operation, is at present known; nor has any approach to a non-operative cure been discovered.

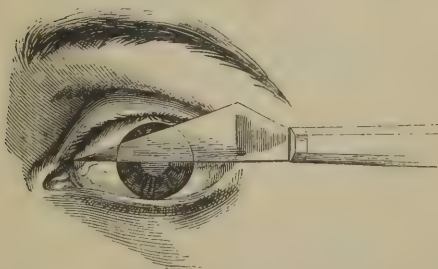
*Operations*.—(1) Extraction of the lens, by which the opaque lens is removed entire from the eye, through a suitable wound in the cornea. (2) Displacement of the lens; either by depression downwards, or reclination backwards, downwards, and a little outwards. "*Couching*," as this operation has been termed, displaces the lens from its natural position into an attitude such that, although remaining within the eye, it allows the rays of light to pass unimpeded through the pupil to the retina. (3) By Solution or Absorption. This operation consists, not in the "*division*" and breaking-up of the whole lens—a proceeding which still finds favour on the Continent, and was formerly practised in this country—but in the laceration of the capsule so as to expose the tissue of the lens to the macerating influence of the aqueous humour, whereby it undergoes complete absorption, a principle of operation established by Saunders, Tyrrell, and other English Surgeons.

*Extraction.*—The *instruments* required are these—a knife having a triangular blade; the back straight and blunt, the point sharp, the edge slanting obliquely and the blade increasing in thickness and breadth towards the handle—Beer's knife. A blade thus shaped occupies the incision in transfixing the cornea, and the semilunar-shaped incision can be made by simply an onward movement with the knife. A curette, or an instrument with a curved needle at one end, and a small spoon at the other. The guarded curette devised by Mr. Walton, is a safer form of this instrument. A sharp hook may also be requisite.

The directions to be remembered in performing the operation are as follow:—To make a crescentic incision in the cornea, through its upper half, and of sufficient size to afford an easy exit to the lens; to make the incision at such a distance from the sclerotic as to ensure both edges of the wound being wholly of corneal tissue; to lacerate the anterior capsule freely, so as to allow of the lens readily slipping through the rent when pressure is made on the globe; lastly, to apply this pressure, gently, in such manner that the lens shall turn slowly on its transverse axis, and thus present its upper margin first at the pupil and then at the corneal wound.

These directions are best fulfilled by the following mode of performing the operation of Extraction:—The patient lying on his back with the head supported, and in a good light; the Surgeon stands behind and uses his right hand for the right, and his left for the left eye. An assistant draws down the lower lid, and steadies it on the malar bone, without any pressure on the eyeball. The operator, with the point of his forefinger, raises the upper lid, locks it under the margin of the orbit, and by resting the point of that finger gently on the upper surface of the globe, and his middle finger against its inner surface, he steadies the eyeball. Holding the knife lightly between the thumb and first two fingers of the other hand, and resting the hand against the side of the face; he punctures the cornea at the centre of its outer margin, a *short distance in front of* its junction with the sclerotic, pushes the blade onward through the cornea, parallel with the iris, and transfixes the other side of the cornea, exactly opposite the external puncture. Owing to the triangular shape

FIG. 325.



of the blade, this incision forms an even semi-circular flap of the upper *half* of the cornea. (Fig. 325.) In making this cut, the blade must constantly fill up the wound, by a steady, onward, movement. If the knife be in the least withdrawn or rotated, a jet of aqueous humour takes place at that part of the wound which is no longer

occupied by the blade, and the iris immediately prolapses over its edge—a perilous juncture. Having completed the incision, the eyelids should be dropped, and all pressure instantly ceased. After a few seconds, the Surgeon again raises the upper lid, and introducing the curette, under the corneal flap and through the pupil, he *freely* lacerates the capsule of the lens, so that the rents shall extend quite across the area of the pupil. Lastly, very *gentle pressure* is made on the under and upper part of the globe, alter-



nately, whereby the lens turns slowly on its axis, and presents its upper edge at the pupil; coming forward to the cornea, the edge is guided upwards, and protruding, the lens escapes through the wound. During this transition of the lens forward, pressure on the globe should be gradually relaxed, lest the escape of the lens be followed by a gush of vitreous humour. The operation is concluded; but, after a short pause, the eye should be inspected to see that the iris is not prolapsed and that the cornea is adjusted.

*Complications.*—*Prolapsus of the iris* during the corneal incision may be rectified by slight pressure over it in completing the incision, or division of the fold of iris being unavoidable, the resulting aperture should be laid into one with the pupil by at once dividing the intervening strip of iris. An *insufficient* corneal incision must be enlarged by means of a short, narrow, blunt-pointed knife. A portion of the *lens* accidentally left behind, in situ, will be absorbed; or, from the anterior chamber, it can be easily removed by the scoop. Escape of the *vitreous humour*, resulting from an insufficient corneal wound and undue pressure on the eyeball, rupturing the hyaloid membrane, is attended with sinking down of the lens into the space left by the lost humour. Pressure must at once cease, and the lens be extracted by means of the scoop or hook entered *behind* that body, retained in position against the cornea lest it sink deeper into the vitreous humour. *Hæmorrhage* into the vitreous humour is the most dangerous complication of all. Severe pain in the eye, and oozing of blood from between the lids, soon proclaim the nature of this accident, but not until the whole cavity of the eyeball has become filled with blood. The sight is utterly lost.

*Conditions contra-indicating or unfavourable for, Extraction.*—(1) Extensive heart-disease is most unfavourable, by enfeebling the supply of blood necessary for reparative union of the cornea. (2) Violent cough of paroxysmal character, perils closure of the wound, and also prolapse of the iris. (3) Fat and flabby persons have less reparative power than thin and wiry, albeit old people. (4) Old age does not contra-indicate the operation; in one case Mr. Dixon operated on a gentleman of eighty-six, and four years afterwards he still enjoyed excellent health and good sight. Commonly, however, after seventy, the reparative power of the cornea is impaired. (5) If one eye only is affected with cataract, the other being free or nearly so, the operation should generally be deferred until vision is lost in both eyes. (6) If cataract be equally advanced in both eyes, and both appear equally suited for operation, it will generally be preferable to operate on only one eye at a time. Much may be learnt of value with regard to the second, by watching the first operation. (7) Extremes of hot and cold weather are unfavourable for the operation, and more especially sultry weather.

*After-treatment.*—The patient having been put to bed, with his shoulders somewhat raised, seclusion and darkening of the room are the circumstances most conducive to recovery. The wound of the cornea, protected by the lids, requires only to be covered with a piece of soft, dry, linen rag, lightly retained by a turn of bandage. The bowels should be kept easily opened, without straining or relaxation; and everything likely to excite coughing, sneezing, or vomiting, should be avoided. A moderate diet may be allowed. In from four to seven days, according to the probable reparative power, the eyelid may be raised, and the corneal wound and iris examined. All going on well, the patient may be allowed

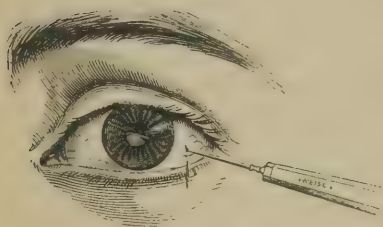
to move about a little; and at the end of another week, if union be sound, the eye may be opened in a weak light, and gradually brought into use. Any exposure to a strong light, or cold, or over-use of the eye, must be avoided. A shade should be worn, and a convex glass used, but it will be difficult to make the two eyes act in harmony.

Inflammation after the operation has been always a great bugbear. But, in a healthy subject, and after a skilful operation, the cornea unites, without inflammation, almost as readily as other soft textures. The state of the eyelids and secretion will indicate the supervention of inflammation, and the necessity for any antiphlogistic measures.

Very rarely, a fistulous wound results, and proves most troublesome. The aqueous humour constantly draining away, the anterior chamber becomes obliterated and the iris lies in contact with the cornea. When this state has existed for several years, all useful vision will be lost.

*Displacement or Couching.*—This operation for cataract is performed by introducing a curved needle through the sclerotic, just behind the margin of the cornea, and in the transverse axis of the globe; penetrating the vitreous humour, the posterior aspect of the capsule of the lens is

FIG. 326.



lacerated with the point of the needle, which is then carried upwards and forwards behind the iris to the front of the cataract, and the lens gently and steadily depressed downwards into the vitreous humour, until it is carried out of sight. (Fig. 326.) There having been held for a few seconds to fix it in its bed, the needle is withdrawn.

*Reclination*—a modification of depression, is performed in like manner; the lens being reverted backwards, downwards, and a little outwards. For either mode of this operation, the pupil should be dilated by a few drops of the solution of atropine, applied about an hour previously.

Displacement of the lens has all the attractive advantages; of simplicity, rapidity, and immediate restoration to sight. But, the chance of some structure essential to vision being injured by a wound in the dark during the operation; or of inflammation supervening in consequence of the lens, as a foreign body, sinking further down on to the retina, or falling forwards against the ciliary processes and iris; make a sum total of accidents adverse to this procedure.

The conditions favourable for displacement, are such hard cataracts as may not be suitable for extraction.

*Operation for Solution and Absorption.*—The pupil being well dilated, the needle is introduced through the cornea, close to its junction with the sclerotic, and thrust onwards until its point reaches the centre of the pupil. Then, the anterior capsule is to be freely lacerated in various directions, and the body of the lens broken up; and the needle may be carefully passed quite through it, so as to lacerate the posterior capsule.

Two needles may be used together, in order to more effectually tear the extensible texture of the capsule; but the one should be passed in

until its point reaches the middle of the pupil, before the second one is introduced through the cornea.

This operation is suitable for *soft* cataracts, especially the congenital in infants; but it is not appropriate for hard cataracts, in old people.

Both eyes may be operated on simultaneously, in infants; but one eye, that most affected, should be operated on first, in adults.

A *fluid* cataract having been subjected to solution by the needle; distressing sickness and perhaps intense neuralgia, almost invariably sets in immediately. The anterior chamber is full of creamy fluid, concealing the iris. On evacuating this fluid, by means of a broad cutting-needle introduced at the point of puncture, the sickness may be averted. Nausea is best relieved by swallowing fragments of ice, and the neuralgia by chloroform liniment applied to the forehead and temple.

The *after-treatment* is simple; both eyes should be kept closed by means of a light bandage for twenty-four hours; when the little puncture wounds in the cornea will have closed. A single operation may suffice to procure absorption, in the course of a few weeks, but this is a rare result; usually, it must be repeated again, and a third time, at an interval of two or three months.

An *Opake Capsule* or *Capsular Cataract*, remaining after the operation for solution, must itself be removed. This can be done by either of three operations. (1) A needle may be introduced as for depression, and the opake capsule torn through; as it shrinks away, the pupil becomes clear. (2) The upper part of the capsule, for four-fifths of its circumference, may be detached by the needle from the suspensory ligament, and then be pushed down below the pupil. (3) These operations having failed, an opening may be made in the cornea, through which the opake capsule is extracted by means of a small hook or forceps. The latter instrument should be so constructed that when its points are separated, the iris shall not fall between them. Such is the canula-forceps.

OPERATIONS ON INFANTS.—Congenital cataracts should be operated on at an early period—within four months after birth; otherwise, the eye born blind, constantly oscillating from side to side, may never acquire directed vision. The child having been swathed in a long towel, and reclining, under the influence of chloroform; the head is steadied by an assistant, and the operation for *solution* performed. The lens is so soft, that this procedure may be completed at once, and on both eyes. A bandage is then applied. Inflammation rarely supervenes, and absorption takes place rapidly.

DISEASES OF THE CHOROID AND RETINA.—(1) *Inflammation* of the Choroid and Retina, respectively, long held a recognised position in Ophthalmic works; the terms, *Choroiditis* and *Retinitis* signifying definite inflammatory diseases of these structures, and each having its own distinctive symptoms. But, in exploring the recess of the eyeball behind the lens, by means of the Ophthalmoscope, the appearances brought to light have not established any such distinctive inflammatory affections; nor as diseases existing independently of other deep-seated inflammation of the eyeball. Deep-seated inflammation has already been sufficiently noticed in connexion with Scleritis and Iritis. "Congestion" of the Choroid, is a mere pathological refinement, of even more doubtful existence, and has no special practical significance.

(2) *Dimness* of sight, may be symptomatic of *various* deep-seated



morbid alterations in the eyeball; unconnected with any changes in the anterior tissues of the globe, and as discovered by external examination with the unaided vision. Thus, the Ophthalmoscope may show masses of pigmentary deposit overspreading the choroidal surface, or an inflammatory state of the choroid, in common with nearly every tissue of the eyeball.

(3) *Defective sight*, in various forms, is apparently unconnected with any morbid state of the choroid or retina, as examined by the Ophthalmoscope; although these functional defects are commonly attributed to structural changes in one or other of these tissues.

(a) *Impaired vision*—or weak sight is a defective sight for near objects. It occurs mostly in those persons who are accustomed to use their eyes much in looking at minute objects. Thus, jewellers, watchmakers, copying clerks, tailors and needlewomen are the common subjects of this affection. Yet it also occurs in those who follow no such occupations, but whose age is that of the turning period of life; say, approaching fifty. At first, small objects or small type, are seen clearly, but in a few minutes they grow indistinct. A moment's closure of the eyes restores the power of vision. The work or type again becomes misty, and the effort to see is discontinued. Larger type will enable a reader to continue reading for a while, but ultimately this can be seen with difficulty, especially in artificial light. The *cause* of defective sight would seem to be a failure of the power of adjustment, due probably to a loss of contractility in the ciliary muscle.

The *treatment* certainly should have reference to the condition as an optical disarrangement, and not to any supposed congestion of the choroid, or disordered digestion.

Convex glasses should be used, of suitable convexity; the lowest powers being tried first, so as to see without strain or effort.

(b) *Musæ Volitantes*.—Little black objects are sometimes seen to fall or float over the field of vision, when the eye is fixed; a sudden turn of the eye will disperse them for a moment, again to reappear. Steady concentration of the vision on any external object, obliterates these black specks, but any slight alteration of the focus of adjustment, brings one perhaps into view, and immediately the whole field of vision becomes crowded with them. They may be seen and moving freely, when the lids are closed, if the eyes be turned towards a strong light. These small, black, moving objects are not due to congested vessels of the choroid, although their real nature has hitherto escaped detection. They move freely in a fluid, through a limited space, and probably near to the retina. The surface of the cornea is not the sphere of action, as proved by their position remaining unaffected in blinking of the eyelids.

Musæ occur commonly in short-sighted persons, usually commencing to appear between the ages of 20 and 30; and having attracted the patient's attention, they seem rapidly to increase in number, owing partly to the habit acquired of bringing fresh bodies into focus. Their presence is quite compatible with excellent and life-long sight. But, they are *incurable*.

AMAUROSIS.—This term, signifying simply dimness of sight, proceeding perhaps to total blindness of one or both eyes, is thus far a functional condition; but the loss of vision is dependent on, and symptomatic of, various structural changes in the retina or choroid, the optic nerve or brain. Some such changes, therefore, are open to examination with the

ophthalmoscope, while others are concealed and must remain hidden within the cranial cavity.

*Ophthalmoscopic Appearances.*—The principal morbid appearances or conditions, as shown by examination of the interior of the eye with the Ophthalmoscope, are:—a *dusky halo* around the optic nerve, commonly attended with general dimness of sight in a slight degree, *amblyopia*; a *white patch* of variable extent and very irregular outline, immediately surrounding the optic nerve; *yellowish-white* spots scattered over the retina, in dimness of sight with Bright's disease; *black pigment* deposits on the retina; a round white patch of exposed *sclerotic*, fringed with a black margin of pigment; *extravasations of blood*, either from the choroid or retina, presenting, after a time, a slight brownish stain, a faint mottling, a linear or stellated cicatricial appearance of a lighter colour than the surrounding tissue. *Serous effusion* between the retina and choroid may occur as a result of acute or chronic inflammation. The acute form of effusion is part of that general disorganization, involving every tissue, of the eyeball, which constitutes *glaucoma*. Chronic effusion may exist in such a small quantity as merely to impart a cloudy appearance to a limited portion of retina; or, it may have detached a considerable extent or the whole of it from the choroid. Limited effusion occurs frequently in the immediate neighbourhood of the optic nerve; appearing as cloudy grayish patches in the midst of healthy tissue, the radiating vessels spread over the rest of the fundus being lost at the edge of the patch. Alteration of focus will bring these vessels into view over the patch. A large extent, or almost the entire retina, having become detached by effusion, presents an opaque grayish surface, or the whole fundus of the eye; which contrasts with the reddish reflecting surface of any undetached portion of retina.

The *optic nerve* at its ocular extremity, may present changes of size, form, and colour, peculiar to itself. But very great variations are compatible with good sight. Certain natural changes incident to advancing life, are—shrinking and deviation from the circular form, with a darkening of colour approaching to gray. Other changes are morbid, though not necessarily of much consequence in respect to vision. *Black pigment* is frequently seen in the form of a thin line around the optic nerve, to the extent of a sixth or a quarter of its circumference. *Degeneration* and atrophy of the nerve, with chronic congestion of the retina, are characterized by ivory whiteness of the one, and a uniform red colour of the other. This combination of appearances is presented in connexion with blindness from cerebral disease involving the optic nerve. *Pitting*, or indentation of the extremity of the nerve, has recently been noticed, in certain cases of greatly-impaired or lost vision. This concave appearance having also been met with in glaucoma, it has been attributed to intra-ocular pressure from over-distension of the eyeball; but it is more probably the result of atrophy and consequent shrinking of the nerve-tubules. Several of the preceding structural changes are, therefore, apparently due to atrophy of either the retina or the optic nerve—*e.g.*, white patches on the retina of old persons, the dense white optic nerve accompanying intra-cranial disease of the optic apparatus, and concave indentation of the nerve, in slowly-advancing blindness. Atrophy of the *whole retina and optic nerve*, without any previous inflammatory process, may also occur. The choroidal vessels are so clearly seen that the retina seems altogether absent; the optic nerve is small, shrunken, irregular in outline, of a dark gray or

drab colour, and the vessels emerging from it form delicate, hair-like, red lines, barely seen across the area of the choroid. Sometimes, the choroidal vessels have undergone a remarkable change of colour; being pale, orange, or buff, instead of red. This general condition of atrophy occurs chiefly in old people; vision gradually fades away year by year, mere perception of light alone remaining at the last. It has been mistaken for steadily-advancing cataract. Ophthalmoscopic examination alone reveals the true nature of this change—a form of amaurosis.

*Symptoms.*—Dimness of vision is the essential symptom in amaurosis, but experienced and manifested in various ways. Coming on suddenly or gradually, and sometimes better, sometimes worse; there may be a general indistinctness of vision—*amblyopia*; or objects appear double—*diplopia*; or half only of an object is seen—*hemipopia*; or objects appear bent, disfigured, or discoloured, or patched. Distances cannot be estimated, and therefore the individual misses his aim in trying to snuff a candle, or pour wine into a glass. The flame of a candle appears split, elongated, or scattered into a brilliant halo. *Ocular spectra* of various kinds make their appearance; sparks, flashes of phosphorescent clouds, or dark spots—*muscæ volitantes*, may be seen when the eyes are turned towards light-coloured surfaces. Great *intolerance of light*, or perhaps longing for light, is sometimes experienced.

These subjective appearances or sensations may be premonitory symptoms of amaurosis.

The pupil is generally dilated, except there be intolerance of light, and the iris is sluggish or motionless. Both eyes may be affected, and equally or unequally; or one eye may be wholly blind, while the sight of the other is perfect. Similar differences are found in the degree of mobility and dilatation of the pupils. Defective motory power in the muscles of the eyeballs or lids sometimes co-exists. The individual, therefore, gropes about with an uncertain gait, his eyes having a vacant stare, and the lids seldom moving or almost fixed.

Examination with the Ophthalmoscope can alone determine and complete the diagnosis.

*Causes.*—The causes of amaurosis are various, and relate either to the nervous or vascular portions of the optic apparatus, or to both. Thus, over-stimulation and *exhaustion* of the retina, by long-continued exertion of the eye on minute objects, or by exposure to glaring light; *anæmia*; or *determination of blood* to the head, as from any stooping occupation or intemperance; or amaurosis may be consequent on *inflammation* or *degeneration*, the *pressure* of extravasated blood, of tumours, or aneurism: or arise from *injury*, as fracture with depression, or concussion, severally affecting the retina, optic nerve, or brain. Besides these local causes, amaurosis may be symptomatic of irritation in a *distant* organ or part—sympathetic amaurosis—*e.g.*, from disorders of the digestive organs, irritation of the fifth pair of nerves, as by tumours or carious teeth; or it may result from *blood-poisoning*—*e.g.*, by lead, or belladonna.

*Treatment.*—Many morbid conditions of the retina and choroid, or further and unknown states of the optic nerve and brain, being associated together, but which have nothing in common with each other, excepting the symptomatic state known as Amaurosis, or dimness of sight, &c., there can be no special treatment of this visual affection. It must differ according to the particular *cause* of the Amaurosis.

The removal of the cause can be accomplished only by having due



regard to its nature. Any amaurotic occupation may be discontinued, whereas, a structural change will probably be permanent and incurable. Remedial measures—also having reference to the particular condition of amaurosis—pertain chiefly to an atonic state, nervous or vascular, hyperæmia and inflammation, sympathetic irritation, and blood-poisons. The treatment with reference thereto must be conducted on ordinary principles.

THE OPHTHALMOSCOPE. — It is scarcely more than twenty years ago, since Cumming first demonstrated the possibility of inspecting the fundus of the human eye, by means of a certain arrangement of light. An instrument for this purpose, the first ophthalmoscope, was invented by Helmholtz and described in 1851. Ruete followed in 1852, with an ophthalmoscope constructed on a different principle; Coccia modified this instrument, and it was still further modified by Anagnostakis, who reduced its construction to extreme simplicity, and perfected its utility.

This ophthalmoscope consists merely of a circular mirror, about an inch and three-quarters in diameter, slightly concave, and perforated in the centre with a round aperture, the tenth of an inch wide. The mirror is set in a metal frame, fixed in a handle.

The eye of the patient should be prepared for inspection by dilating the pupil with atropine, unless it be already dilated from disease.

The application of the Ophthalmoscope, in regard to the various details necessary for a complete examination of the eye, is thus described by Mr. Dixon:—"The observer and the patient sit face to face, in a room from which daylight has been excluded, the only source of illumination being a lamp, or, still better, a jet of gas issuing from a jointed tube, so that the flame can be placed higher or lower, according to the height of the patient's head. The flame should be on a level with his eye, and just far enough behind him to prevent any of the direct rays falling on his cornea. The chimney surrounding the flame must be of transparent glass, and, if faintly tinged with blue, it will modify the red rays of the flame, and impart a whiteness to it, nearly resembling that of ordinary daylight. The observer places the back of the mirror close to his own eye, so that he looks through the central aperture, and holds the instrument at such an angle that the reflected light from it falls upon the patient's pupil. This is always very difficult for a beginner to accomplish; but a little practice soon makes it easy. The observer will know that he holds the instrument in the right position, and at a proper distance from the eye, by seeing the retina assume a brilliant reddish appearance. Still holding the ophthalmoscope in the same position, he takes in the other hand a convex glass, of two inches or two inches and a half focus, and places it at such a distance in front of the cornea as to allow of the retina coming within that focus. If the fundus of the eye be properly illuminated, and the convex glass correctly placed, some of the retinal vessels will now be distinctly seen.

To bring the optic nerve into view, the *patient* must direct the eye a little towards the nose, and by turning the eye in various directions every portion of the retina is successively brought under the view of the observer. The necessity for varying the position of the eye constitutes a great objection to the more complicated ophthalmoscopes, which are fixed to a table or other support; and some eyes are so unsteady, and so little under the patient's control, that the observer is obliged to follow their

movements by slight changes in the position of the ophthalmoscope, which can only be effected when the instrument is held in the hand.

Some ophthalmoscopes present an upright, some a reversed image of the optic nerve and retina. The simple mirror of Anagnostakis, used in combination with a convex glass, in the manner here described, certainly allows of our seeing, in their real position, parts which do *not* fall within the focus of the patient's crystalline lens."

HEALTHY APPEARANCES.—(1) *Retina*.—The colour of this tissue is not uniform in every eye: its tint varies from pale red through shades of red, orange, and yellow orange, to buff. In a full-blooded person, and with a vigorous state of the circulation, the colour is much redder than in the anæmic, and with a feeble circulation. The colour of the retina is partly due to its own capillary network, and partly to the vascular choroid behind it; the amount of redness thence transmitted depending on the quantity and condition of the hexagonal pigment between it and the retina. The retinal vessels radiate from parent-trunks—the central artery and vein, issuing from a central point in the optic nerve. The arteries present some features of distinction from the veins. An arterial trunk has a more direct course, is of smaller calibre, a paler red colour, and presents a double outline, as compared with the adjacent vein; both these latter peculiarities of appearance depending on the greater thickness of the arterial wall. This distinction becomes less marked as age advances. No pulsation can be detected on simple inspection, but pressure on the globe elicits a distinct pulsation, both in the arteries and veins. The sight, in this state of the circulation, may remain unimpaired.

(2) *Optic nerve* at its ocular extremity—the *Optic disk*.—This structure presents a great variety of appearances, and which do not affect the sight. The optic disk has a circular shape, and its colour, as compared with the reddish tint of the surrounding retina, is creamy white, or sometimes a pinkish-gray as in the cortical portion of the cerebral convolutions. The extreme margin of the disk is more decidedly white than its area. From the centre of the nerve-disk, the retinal artery and vein emerge; commonly, each as a single trunk, sometimes in two or three trunks. The vessels pass off the nerve in straight or wavy lines, or sometimes form several abrupt curves on the surface of the nerve before quitting it. As age advances, the optic disk deviates from the circular form, becomes smaller in size, and of a darker tint, approaching gray.

(3) *Choroid*.—The distinctness of this tissue will depend on the degree of transparency of the retina, and the condition of the hexagonal pigment-cells intervening. The appearance varies also considerably with age. In young persons, the choroidal vessels are dim and indistinct, as if overspread with a thin semi-opaque film; but, in old persons, these vessels appear as if not overlaid by the retina. They are much larger than the radiating retinal vessels, closely packed with narrow linear interspaces, showing dark pigment. The colour of the choroidal vessels changes during life; at an earlier period presenting a bright red, in old age, this colour becomes mixed with a brownish tint.

(4) *Vitreous humour, aqueous humour, the lens, and its capsule, and the cornea*.—These parts of the eye are transparent, in the healthy state, and thus admit of clear inspection of the whole of the posterior portion of the interior of the eyeball. Contrasting with the healthy state, as the standard of comparison, the morbid appearances of the same tissues within this portion of the eyeball have already been described. They remained

for centuries unknown, and they never could have been discovered without the aid of the ophthalmoscope. This instrument has, in fact, revolutionized the pathology of deep-seated diseases of the eyeball, and this department of Ophthalmic Surgery.

**GLAUCOMA.**—An inflammatory condition, apparently, and which gradually involves every tissue of the eyeball; resulting in its complete and permanent disorganization, with total blindness.

**Acute Glaucoma.**—The sight is rapidly lost. The attack commences—usually in the evening—with dull pain in the eyeball, redness of the sclerotic and conjunctiva, and mistiness of sight. The *pain* soon acquires an acute and neuralgic character, piercing through the ophthalmic division of the fifth nerve, and radiating even to the second and third divisions. In a few hours, the iris has acquired a slaty discoloration, and the pupil become irregular in form, dilated and quite immovable. In a day or two the cornea loses its brilliancy, the conjunctival epithelium appearing minutely granular. The eyeball is singularly tense and of *stony-hardness*; and the slightest pressure aggravates the pain. Sight is lost by this time, possibly within a few hours, and so completely that even a bright light cannot be perceived. One eye only may be attacked, but frequently the other eye follows in a variable period; one, two, or several days.

The period of life is usually past middle age; and some break-down of the general health or mental anxiety seems frequently to have predisposed to the attack.

**Chronic Glaucoma.**—The eye has undergone the same structural changes, only in a more confirmed and conspicuous state. Thus, the tension and stony-hardness of the eyeball is greater, and the vascularity of the sclerotic more pronounced; it being marked with faint dusky patches, and sometimes a slight vascular zone, and traversed by large purple tortuous veins emerging abruptly close to the margin of the cornea. *Opacity of the lens* is the distinctive character; this body has also a full swollen appearance, as if it had undergone maceration, and were almost bursting through its capsule; its *colour*, moreover, has changed to a grayish or greenish drab, dirty yellow, or dull orange tint. This greenish or glaucous aspect of the lens, appearing as it were a reflex tint from the fundus of the eye, was formerly regarded as essential and peculiar to the disease, glaucoma.

The order of *sequence* of the morbid changes would seem to be;—congestion in the retina and choroid, continuing perhaps to effusion between these two structures. Hence, pressure on the vitreous humour, and bulging forwards of the lens and iris; followed by congestion and inflammation of the iris and cornea, the lens becoming opaque as a result of its impaired nutrition. Sight is lost, certainly as to the perception of objects, sometimes the retina is even insensible to light.

The disease, in its chronic form, is of insidious origin and slow progress; advancing, with intervals of cessation, during months or years. It occurs in persons beyond middle age, and who have a pale, worn appearance.

The granular condition of the corneal epithelium, the haziness or complete opacity of the cornea, in Glaucoma, precludes any examination of the fundus of the eye by means of the ophthalmoscope. It thus differs from Amaurosis, in respect to the applicability of this exploring instrument. Usually, nothing more can be discerned than a faint reddish glow



from the retina, without any trace of the optic nerve or retinal vessels. It is important to bear in mind this absence of what are sometimes designated, the ophthalmoscopic appearances within the eye in Glaucoma. Probably appearances so described have reference to Amaurosis with excavated optic nerve; a condition which may co-exist with perfect transparency of all the media of the globe.

*Treatment.*—*Acute* Glaucoma may succumb to prompt antiphlogistic measures; cupping, counter-irritation, and constitutional treatment as perhaps that for rheumatism or gout. Opium may relieve the pain. *Chronic* Glaucoma is altogether beyond the reach of any such treatment; the structural disorganization cannot be prevented, it having already taken place, more or less completely.

*Iridectomy.*—This operation was proposed by Graefe, in 1857; and it has proved more successful than any other mode of treatment. It consists in removing a portion, about one-sixth, of the iris, by a small puncturing incision through the cornea close to the sclerotic; the iris being seized with a fine forceps, is drawn out sufficiently, and the portion cut off. Thus, it was said, the “intra-ocular pressure,” on which the whole state of the eye depended, would at once be relieved, and the Glaucoma *cured*. When, however, complete structural disorganization of the eye has taken place; evidently, the operation must be unsuccessful.

**SHORT SIGHT, and LONG SIGHT.**—These conditions represent exclusively the *range*, not the power or clearness, of vision. They depend on alterations, either in the refractive power of the transparent media of the eye, as an optical instrument, or in the adaptive power of the organ; in either way, the focusing power of the eye is altered. And such alteration is of an opposite character in the two ranges of vision.

*Short-sight—Myopia.*—In this state of visual range, the eye can see near objects clearly, while distant ones appear dim and confused. The rays which ought to come to a focus upon the retina, converge to a point in *front* of it. This has been attributed to over-convexity of the cornea, but the convex cornea of a far-seeing bird disproves this explanation. Short-sightedness seems to arise from one or more of three causes; over-convexity of the lens, elongation of the globe in its antero-posterior axis, or from an unusual power of adapting the eye to near objects by changing the position of the lens. The ciliary muscle is probably brought into action in the adaptation of vision, thus increasing the convexity of the lens, and consequently its refractive power.

The habit of looking at minute objects may have this effect, and assuredly induces short-sightedness. Hence certain occupations from childhood upwards, have a causative influence; as in learning to read or the study of music; and certain classes of persons are more subject, as literary men, and artisans engaged in delicate and minute manipulations. Out-door pursuits have rather a preventive tendency. Commencing, usually, a little before puberty, short-sight increases up to about the age of twenty-five; when the focus settles down to that which remains permanent through life. The sight does not improve as age advances. This affection is frequently hereditary.

*Treatment.*—Any habit or occupation inducing short-sight must be abandoned; and an opposite habit or pursuit cultivated. The optical remedy consists in using *concave* glasses, of a focus suitable to the individual case; and worn only as occasion requires. Spectacles—not a single glass—of the lowest concave power sufficient to compensate for the myopic

condition, should be the first selected; and these exchanged for a higher power when felt to be necessary.

*Long-sight—Presbyopia.*—In this state, small and near objects appear indistinct, while distant ones are seen clearly. The rays of light come to a focus *behind* the retina. This condition may be due to flattening of the lens, diminution of the antero-posterior axis of the globe, or from want of the power of adjustment.

Long-sight commences about the turn of life,—say fifty; reading then becoming more and more difficult. The book is held at some distance, even arm's length, from the eyes; and there is as much straining and sense of effort to look at a sufficient distance away from the object,—in order to bring the focus forwards to the retina, as in short-sight to look nearer,—thus to turn the focus backwards to the retina. This difficulty of long-sightedness increases as age advances.

*Treatment.*—Any endeavour to accustom the eyes to the nearer range of former years, should be abandoned, as being foolish and prejudicial. *Convex* spectacles must at once be resorted to; the lowest power which may be required being used first, and increased as the sight demands. The *test* of sufficiency in respect to the glasses selected for short-sight, or for long-sight, is, that the person shall be enabled to see objects distinctly at the average distances of sight, without any magnifying effect or sense of effort.

*Faulty perception of Colours.*—Colour-blindness,—*acritochromacy*, is an inability to discriminate between colours. Various other terms have been devised to designate this defect. It is generally an inability to perceive red, and the compound tints into which this colour enters. Blue is almost always appreciated; and yellow, always. The cause of this defective perception, is probably not in the eye itself, but in that portion of the brain to which the impressions of light are conveyed. It is a cerebral affection, but may be temporary. An important practical suggestion was made by Wilson, that persons employed on railways and elsewhere, who are required to observe coloured lights as signals, should be previously tested as to their power of perceiving colours with perfect accuracy.

No treatment can be said to be curative or even palliative.

*Day-sight* or *Hemeralopia*, and *Night-sight* or *Nyctalopia*; are terms used to designate intermittent blindness, conversely, by night, and by day.

*Day-sight* is perfect in broad daylight, but the power of vision declines after sunset and in twilight. This loss of function is caused apparently by exhaustion of the nervous power of the retina, from exposure to strong sunlight; the weaker stimulus of twilight or moonlight then being insufficient to produce the sensation of light. Hence this deficiency occurs commonly in tropical countries, and in persons who have just returned from long sea-voyages, especially from the East or West Indies.

Rest of the over-stimulated retina would seem to be the most important indication of treatment; coupled with tonics and good food when toil and hardship have contributed to the exhaustion.

*Night-sight*, or inability to see by daylight, is not probably a special affection, independently of any inflammatory or other disease of the eye which may be attended with intolerance of light. Scrofulous ophthalmia is thus nyctalopic.

DISEASES OF THE EYEBALL, or of its MOTOR APPARATUS.—(1) *Protrusion of the Eyeball.*—An unnatural prominence of the eyeball may be

unconnected with any disease of the organ. The eyes have a peculiar and painfully staring expression, as if they were too large for the sockets. The lids can be shut, the eyes moved freely in all directions, and sight is unaffected. Both eyes are equally prominent. These peculiarities distinguish this condition from the projection caused by any orbital tumour.

It exists or occurs mostly in women of feeble or hysterical constitution, and would seem to be due to an atonic state of the recti muscles; but the free movement of the eye is incompatible with this explanation of the protrusion.

No known *treatment* has any remedial influence.

(2) *Dislocation of the Eyeball*—from its socket—cannot take place without rupture of the optic nerve, allowing the eye to be thrust out upon the cheek. Lodgment of the upper eyelid backwards, behind the greatest convexity of the globe, has occasionally happened.

(3) *Tumours within the Eyeball, or Orbit*.—Various kinds of tumour are liable to form in this, as in other parts. *Cancer* is, perhaps, the most frequent; *hydatids*, or *exostosis*, are occasional forms of growth.

The *diagnosis* of an intra-orbital growth will be difficult, and perhaps impossible, at an early period; and still more so, its nature. All give rise to gradual displacement and protrusion of the eyeball. The anterior portion of an intra-orbital growth can sometimes be examined with the tip of the finger between the orbit and globe, in this situation. Hydatid cysts present a feeling of elasticity and fluctuation, and by a fine puncture sometimes, the true nature of the mass is discovered. An intra-ocular growth will probably be shown by the ophthalmoscope. At a subsequent period of growth, the nature of the tumour may be partly determined by its progress. Encephaloid tumour, and the melanotic variety in particular, progresses most rapidly; exostosis, most slowly. When the eye has burst, the kind of tumour may be declared; as, for example, a fungoid melanotic tumour.

*Treatment*.—No medicinal treatment has any more controlling influence over an orbital or ocular tumour, than in respect to the same kind of growth situated elsewhere.

The operation of removing a morbid growth from the orbit implies a previous exact diagnosis, as to whether it involves the eyeball, and is limited to the orbit or extends into it from the cranium. Such diagnosis will mostly be impossible. In performing the operation of extirpation, any injury to the globe or optic nerve must be most carefully avoided; another difficulty, if not impossibility.

REMOVAL OF THE EYEBALL.—(1) *Partial removal*.—Non-malignant disease, and occasionally destruction of the eye, by, or in consequence of injury, are the conditions which may justify excision of the anterior portion only of the eye, with a view to afterwards introducing an artificial eye.

No particular directions are requisite for the performance of this operation. The removal of a staphylomatous projection of the cornea or sclerotic, by means of a cataract-knife, sufficiently illustrates the operative proceeding. The eye collapses, the sclerotic case left shrinks into a nodule, forming the base of support, and when tenderness has ceased, an artificial scale eye is introduced between the lids.

*Extirpation of the eyeball*.—Removal of the whole eye should never be resorted to while any sight remains in the organ; *excepting* for malign-



nant disease, or when the irritability of a partially disorganized eye threatens to affect the sight of the other eye, sympathetically.

The operation is best performed as follows:—The patient reclining, and under the influence of chloroform, an incision is made from the outer commissure of the lids backwards, to a sufficient extent just to gain free access to the globe; the lids are then held well apart by retractors or curved spatulæ in the hands of an assistant. By passing the knife from the incision to the inner commissure, above and below the globe, carefully avoiding any exposed portion of either lid, the conjunctiva is entirely divided, with the ocular attachment of the levator palpebræ and other surrounding muscles. Then, seizing the globe with hooked forceps and drawing it inwards, the knife enters the orbit externally; the eye is detached, the optic nerve and artery are divided at the apex of the orbit, and the attachments severed internally, thus completing the extirpation of the organ. The lachrymal gland should be removed also; it is commonly involved in the disease of the ball, and is always useless, or its presence would occasion inconvenience afterwards, as I have noticed by a continued secretion of tears overflowing the cheek. Hæmorrhage must be arrested by sluicing with cold water, and the application of a graduated compress, well placed upon the artery at the apex of the orbit. The eyelids are closed, and a light bandage drawn round the head covering the other eye.

Opiates will have to be administered from time to time, to relieve the severe penetrating and claspings pain in the head. The compress may be removed in about two days, according to the probability of hæmorrhage, and not reapplied unless it should recur. The orbit is to be gently syringed, the wound cleansed, and water-dressing applied, or other dressing on ordinary principles of treatment.

**STRABISMUS, or SQUINT.**—The pathology and causes of Squint have already been noticed in connexion with Deformities of the Face (p. 596). It remains only to here describe the operation for its cure or relief.

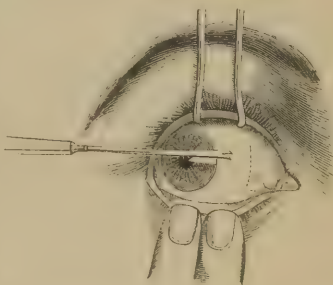
**Operation.**—The old operation of 1840, when first the cure of strabismus by *tenotomy* was introduced, consisted in dividing the tendon of the internal rectus muscle, for convergent strabismus, in the following way:—

The lids being held apart by an assistant, a small, sharp, hook was stuck into the sclerotic, close to the inner margin of the cornea, so as to fix the eyeball and draw it outwards. (Fig. 327.) Then, the Surgeon raising with the forceps a fold of conjunctiva midway between the cornea and plica semilunaris, divided it vertically with scissors, snipped through the subconjunctival tissue covering the tendon of the muscle, passed under it a blunt hook, or director, and upon this divided with scissors, or with some

kind of knife, either the tendon itself or the adjacent muscular portion of the rectus muscle.

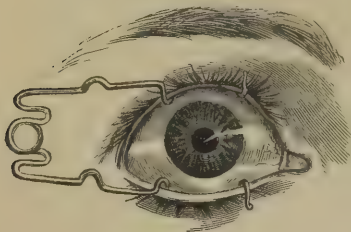
The defects of this mode of operation were, a too great separation of the ocular conjunctiva, inducing a subsequent retraction of the semilunar fold, and an over-weakening, amounting sometimes to utter loss of action, of the divided muscle.

FIG. 327.



*Sub-conjunctival* division of the tendon of the contracted muscle is now commonly practised. This operation, as for convergent squint, is thus performed:—"The lids," says Mr. Dixon, "are kept asunder with a spring speculum (Fig. 328); and an assistant draws aside the globe, by nipping up with the forceps a little fold of loose conjunctiva near the margin of the cornea, at the opposite side to that on which the muscle is to be divided. Supposing the internal rectus to be chosen for operation,

FIG. 328.



the Surgeon, with scissors, divides the ocular conjunctiva horizontally, on a level with the lower edge of the cornea, and extends the incision towards the semilunar fold. Then he nips through the sub-conjunctival tissue, and having clearly exposed the sclerotic, slides upwards, between it and the rectus, a curved director. This serves to raise the muscle and make its fibres tense, and then with scissors the muscle is

carefully cut through, close to its insertion into the sclerotic. This section of the muscle cannot be completed at a single stroke, but requires repeated use of the scissors, so that no fibres may be left undivided. A careful exploration with the blunt hook or director must be made, to detect any undivided fibres, before the spring speculum is finally withdrawn."

The advantage of this improved mode of operation is, that it prevents the deformity arising from retraction of the semilunar fold, which presents a most conspicuous sort of cavity at the inner corner of the eye, almost worse, in appearance, than the leering cast of squint. The instruments required are fewer: no sharp hook, nor the multiplicity of curious little knives, formerly used and abused.

*Graefe's* operation consists, in dividing the conjunctiva a little below the equator of the globe and a few lines from the cornea, almost over the insertion of the tendon; then, exposing the sclerotic just enough to pass a curved blunt hook beneath the tendon, which is drawn well into the conjunctival wound before using the scissors. It is then snipped through close to its sclerotic attachment.

The advantage of this method is, that the tendon is brought quite into view, and, therefore, not likely to escape division, which is one of the dangers of the sub-conjunctival operation.

Division of each internal rectus is generally requisite, even when inversion of the better eye is comparatively slight. If the squint be wholly confined to one eye, the single operation will be sufficient.

In dividing the *external* rectus, it should be remembered that the muscle is broader than the internal rectus, and is also inserted farther back from the corneal margin.

Chloroform, in operations for strabismus, is convenient for the purpose of steadying the eye; but it prevents the Surgeon ascertaining whether the muscle has been effectually divided, by requesting the patient to attempt inversion, or eversion, of the eye.

*After-treatment* is very simple. A pad of wet lint may be placed over the eye, and retained by a bandage. In a few hours, when the risk of ecchymosis, "black-eye," has ceased, this dressing may be discontinued;

and the eyes at once brought into use, especially for distant objects. Sometimes, a little, button-shaped clot of blood remains in the sub-conjunctival cellular tissue, forming a little prominent excrescence, attached by a narrow pedicle. This may be snipped through some weeks after the operation.

## CHAPTER XLI.

### INJURIES AND DISEASES OF THE EAR.

**INJURIES.**—*Wounds.*—The external ear is sometimes wounded in injuries of the scalp; the lobule and perhaps the pinna or cartilaginous portion of the ear being cut or torn and partially detached.

No such portion, however apparently destroyed, should be removed. The part should be cleansed of any grit or other foreign body, and neatly replaced with a few points of suture and strips of plaster. I once had a remarkable instance of union of the external ear, under it would have seemed most unfavourable circumstances. (P. p. 765.)

*Foreign Bodies.*—Various substances, as bits of stick or pencil, glass beads, pebbles, or peas, are not unfrequently pushed into the ears of children in play. I once found a pin at the bottom of the external auditory meatus.

Such bodies are removed more or less easily. It is always advisable to see the body before making any attempt; both to be certain of its presence and its shape. If deeply placed, it may be discovered by simply drawing the ear outwards and backwards, and inspecting the passage in a good light; or it may be requisite to introduce an ear-speculum, a small trumpet-shaped tube having a brightly-polished interior. *Pointed* bodies can be readily extracted with forceps; round bodies, more conveniently, by means of an ear-scoop (Fig. 329), turned round the body, which is then hooked out or eased out, according to its size. Sometimes, direct manipulation having failed, or as preferable to that method of removal; injecting the ear with tepid water, thrown in forcibly from a large brass syringe, will succeed in washing out the body by the reflex action of the water from the tympanum.

After a fair trial, if the foreign body still stick fast in the meatus, it should be left there. It may become loosened; and this chance is better than poking instruments forcibly into the ear with the view of extracting it, and even then again failing to remove the body. In the one case, inflammation will probably ensue; in the other, it will be inevitable, and death has been known to result.

**DISEASES.**—**EXTERNAL EAR.**—This external appendage is subject to various affections.

(1) *Displacement* as it were, so that the ears project laterally from the head, giving a very unsightly appearance, that of asses'-ears; which not unfrequently occurs in children. It seems to arise from wearing a cap thrust down upon the ears, bending the pinna downwards and forwards;

FIG. 329.





or it may be a congenital deformity. Correction of this displacement may perhaps be effected, by avoiding its apparent cause and contriving that the ears shall have a backward direction.

(2) *Hypertrophy* is sometimes seen, particularly in idiots. A *Fibroid* tumour of either the cartilaginous portion of the pinna or of its lobule, is not uncommon in negroes; in the latter situation, it is described by Paget as having arisen occasionally, in this country, from the irritation produced by wearing ear-rings. This growth is apt to recur after removing it; but the only treatment is excision. *Cysts*, containing a glairy or a sanguineous fluid are occasionally met with in the pinna; the latter cystic formation occurring especially in the insane, and being known as *hæmatoma auris*. *Steatomatous* and *fatty* tumours in the cartilaginous pinna, and *Nævus* or erectile tumour in its lobule, may also be enumerated among the growths to which these portions of the external ear are subject. *Gouty concretions* or *tophi* are not unfrequently deposited in the external ear of gouty subjects. They are specially described by Dr. Garrod in his well-known work.

(3) *Eczema* may be noticed as a not uncommon affection. *Porriigo* also occurs in connexion with the disease of the scalp. I have seen it continue after the scalp-affection had disappeared, and result in a very troublesome discharge from the meatus. These, or any affections common to other parts of the body, must be treated on general principles, or in conjunction with the disease of which it forms part.

*External Auditory Meatus*.—This passage, leading from the pinna to the tympanum, is liable to various affections, which require an examination of the meatus to determine their diagnosis and treatment.

The *meatus* deviates from a straight direction inwards. At the external orifice, it inclines upwards and forwards, then turns a little backwards, and lastly, dips downwards and forwards to the tympanum. The calibre of the passage is narrowest about the middle; the outer opening is larger in its vertical diameter, but the tympanic end is slightly oval transversely, and it has an oblique direction, thus making the floor of the meatus somewhat longer than its roof. Externally, consisting of a fibro-cartilaginous and moveable tube, internally it is an osseous and fixed tube—in the substance of the temporal bone. Throughout its whole extent, the meatus is lined by a thin cutaneous membrane prolonged from that of the pinna. The character of this membrane varies in different portions of its extent. The external orifice presents fine hairs pointing inwards, and numerous sebaceous follicles; the inner glandular portion is beset with ceruminous glands which secrete the ear-wax, an adhesive substance forming a ring around the tube at this its narrowest part; the innermost or bony portion presents a fine, smooth, dry, pearly white, shining appearance; in a healthy state not being coated with wax. The *membrana tympani*, closing the passage obliquely, is grayish white, dry, and semi-transparent. Within it, is seen the handle of the malleus, directed from above downwards, and slightly forwards. This bone, extending about half down the membrane, divides it into an antero-superior and a postero-inferior portion; the one is flat or slightly concave, the other, in a perfectly healthy condition during life, is convex towards the external aperture. This lower portion has also a more glistening aspect; and when inflamed, it becomes highly vascular, thickened, granular or villous, and secretes a purulent matter.

*Ear-speculum*.—The external portion of the meatus may be brought

into view, by drawing the ear in various directions so as to render the meatus a straight tube; the patient being placed in a good light.

But all the foregoing appearances will be seen more clearly, and the examination of this passage completed, by means of the ear-speculum. This is simply a trumpet-shaped tube, having a bright reflecting interior; and made for convenience in two or three sizes.

(4) *Wax accumulation in the Meatus*.—Dark coloured and hardened little masses of wax form, not unfrequently, in the meatus of young persons; such concretions occasion crackling-noises in the head on opening and shutting the mouth, and are a common cause of deafness. They can be seen on examining the passage with an ear-speculum; and Toynbee's instrument which has a double convex shape is the most serviceable.

*Treatment* consists simply, in softening and washing out the wax from the meatus, by injecting tepid water somewhat forcibly by means of a large-sized brass ear-syringe. A trough fastened by a spring from the other side of the head, is placed below the ear to conduct the water into a basin. No air-bubbles should be thrown in from the syringe, and as the waxy-concretions come out into the basin, fresh tepid water should be used. Softening the wax by previously introducing a drop or two of glycerine into the ear, may facilitate its removal. The small elastic suction-bottle and tube, known as Margett's, will enable the patient to pass a gentle stream of warm water into his own ear, as a fomentation. In case of pain or inflammation, this affords great relief.

(5) *Thickening of the cuticle*.—In this state, the cuticle lining the meatus becomes thickened and hardened, assuming a dull white appearance, narrowing the passage, and occasioning some degree of deafness. It may be a consequence of long-continued otorrhœal discharge.

Syringing the ear to remove any loose flakes of cuticle, previously softened if needs be, by glycerine; must be followed by some gently stimulating application. A weak solution of nitrate of silver, or dilute citrine ointment, may be brushed over the membrane; and often with much advantage in restoring it to a thin and healthy state.

(6) *Polypus*.—Three species of polypoid growth may form in the meatus. Commonly, it is a *gelatinous* polypus, the size of a pea or bean, smaller, or larger and even projecting from the meatus; when small, of a florid-red colour, and growing chiefly from the bottom of the meatus. It consists—as shown by Mr. Harvey—of fibro-cellular tissue and fibro-plastic cells, like the structure of gelatinous nasal polypus; and is always attended with discharge. It is a consequence of otorrhœa. Very rarely, a *fleshy* pedunculated polypus forms, nearly colourless, having a thin cuticular covering, and growing usually from the middle glandular portion of the meatus. This species is not accompanied with discharge; it is unattended with pain, and does not appear as the result of inflammation. A third species, is *cancer-tumour*, within the meatus. In its earliest stage, this may not be distinguishable, otherwise than by examination under the microscope after removal; the rapid return of the growth, paralysis of the face, and other signs of the invasion of neighbouring organs, will, eventually, discover the true nature of this kind of polypus.

*Treatment*.—Complete removal of the polypus is the only cure; the point whence it sprung should then be touched with nitrate of silver—repeated from time to time, whenever it threatens to sprout again; and the meatus regularly syringed with an astringent lotion. The lunar caustic should be cast in a very fine stick, like the lead of a patent pencil;

or the blunt end of a fine probe may be coated with it, so that it shall be applied exactly to the right spot. Removal may be accomplished by a twist off with Assalini's hook-forceps; or if more firmly attached, the polypus may be cut off with a fine pair of scissors, or its neck caught and cut through by Wilde's snare. Another ingenious instrument was contrived by the late Mr. Avery for grasping the neck of the polypus.

(7) *Otorrhœa*.—This is a discharge from the external auditory passage, of a purulent or muco-purulent character, thin or thickish, a yellowish colour, and offensive odour. It occurs usually in scrofulous subjects; and the discharge may proceed, either from the mucous membrane lining the passage as a result of catarrhal inflammation, or it may be connected with caries of the petrous portion of the temporal bone, associated with disease and destruction of the tympanum and of the internal ear, as a consequence of otitis.

The *catarrhal* inflammatory form of *otorrhœa* is not uncommon in children, and is apparently excited by cold or stomach disorder, especially during teething. It may accompany scrofulous ophthalmia, porrigo, and other eruptions, or be a sequel of an eruptive fever, or of any weakening illness. The child is feverish and complains of *ear-ache*, the meatus is swollen and vascular, and soon there issues the characteristic yellowish discharge.

*Otorrhœa* may subside as the health improves; or once established, it may continue for years or for life. In the latter condition, or *chronic* protracted *otorrhœa*, the daily discharge acquires an almost periodic character; it is perhaps preceded by itching in the meatus, and relieved by scratching with the head of a pin or other pointed body, which is almost immediately followed by a flow of the offensive secretion. Chronic *otorrhœa* may remit a little occasionally, but this subsidence soon produces a sense of fulness and discomfort in the ear, until discharge recurs, of a thicker curdy consistence and more fœtid odour. It may then be discovered by a stranger on entering the room, or even by the accustomed but unhappy sufferer in an atmosphere of his own creation. Confirmed *otorrhœa* cannot, however, be safely suppressed. The entrance to the meatus becomes enlarged and open, owing to the patient's habitual introduction of a handkerchief on the point of the finger; and the result of the disease is absolute deafness with the affected ear.

*Treatment*.—Catarrhal inflammatory *otorrhœa* in scrofulous children, will probably yield under the application of a large poultice to the ear, followed by astringent injections, if the discharge prove obstinate. There is no occasion for the fear of "driving it in upon the brain," as some mothers imagine. Purgatives and tonics will be required to restore the general health. *Otorrhœa* following internal otitis may be amenable to the same plan of treatment. Astringent injections are even more appropriate, when very gently applied. Twice a day, the ear having been lightly syringed out with warm water to remove the discharge; a tepid lotion of alum, sulphate of zinc, or acetate of lead, should be dropped into the meatus, and after remaining there two or three minutes, be allowed to run out. The general health must be promoted by tonics, alteratives, and aperients, and by warm baths.

Certain contingent states of the discharge require some modification of the local applications. For a very fœtid discharge, a lotion may be used, composed of two drachms of solution of chloride of lime to half a pint of water. If the discharge produces excoriation of the ear or the



neck, these parts should first be fomented, and then smeared with an ointment of hyd. præcip. alb. But it is not advisable, in general, to insert ointments into the meatus. If the discharge be obstinate, the whole interior of the meatus should be pencilled with a solution of nitrate of silver—gr. v. ad ʒj, twice a week, with a camel's-hair brush.

If in the course of the treatment, an attack of acute pain and fever occur, and the discharge stop suddenly, leeches, fomentations, and purgatives must be resorted to; and astringent applications resumed only when the acute inflammatory state has ceased.

*Fungous granulations.*—This condition is a very common consequence of otorrhœa. The granulations are usually found at the bottom of the meatus, or springing from the membrana tympani, or from the cavity of the tympanum, after the membrane has been perforated by ulceration. Sometimes, the membrane is covered with florid granulations, and resembles the *granular conjunctiva*.

*Treatment.*—The solution of nitrate of silver should be regularly applied to the fungous surface by a camel's-hair brush, and astringent injections.

**INTERNAL EAR.**—(1) *Otitis.*—Inflammation of the internal ear or tympanic cavity, may be either acute or chronic.

*Acute otitis* is characterized by pain, most excruciating, generally worse at night, and increased by speaking, swallowing, sneezing, or coughing. Great tenderness around the ear and a feeling of distension of the aural cavity, soon supervene, with throbbing noises in the head and deafness, or rarely, morbid sensibility to sound. The meatus is found more or less red, swollen, and dry; and the membrana tympani dull, opaque, and vascular. Violent fever frequently accompanies these local symptoms. Ulceration of the membrana tympani may take place, and a purulent discharge from the meatus affords great relief or terminates the inflammation. Suppuration within the tympanum and mastoid cells of the temporal bone, occasionally takes place; resulting either in obstinately chronic otorrhœa, caries of the bone, irritation of the membranæ of the brain, abscess in the substance of the brain, or even pyæmia.

*Chronic Otitis.*—The inflammation is frequently insidious, attracting little attention, until it has lasted for a long time. Pain, of a rather trifling character and short duration occurs at intervals, noises in the head, and a gradually increasing dulness of hearing, which is often the first symptom complained of. The membrana tympani has a thickened appearance, and is occasionally covered with cheesy tuberculous matter, or fibrous concretions. Fibrous bands stretch across the tympanic cavity; connecting the inner surface of the membrane to the inner wall of the cavity, or to the incus and stapes; or extending from the crura of the stapes to the adjoining wall of the cavity, enveloping this bone with bands of adhesion. Sometimes, they occupy and block up the whole cavity. Ultimately, the membrana tympani becomes ulcerated, the little bones,—ossicula, are detached and discharged, and the entire middle ear is disorganized. Caries within the mastoid cells and suppuration in the tympanum, may follow.

*Causes.*—Exposure to cold, especially currents of cold air, or sea-bathing; rheumatism or gout, the scrofulous diathesis, or perchance, syphilis; not unfrequently also, otitis is a consequence of an eruptive fever, particularly scarlatina; and occasionally, of some violence, as by forcible syringing or freely probing the ear.

*Treatment.*—Acute inflammation of the tympanic cavity requires prompt and decided antiphlogistic measures. Locally, leeches behind the

ear and the continuous application of poultices or warm fomentations. should be followed by blistering. In the event of any swelling or fluctuation over the mastoid process; Wilde and Harvey both recommend an incision down to the bone, about an inch behind, and parallel to, the attachment of the ear. The intense pain may be relieved by painting with the strong tincture of aconite behind the ear. The general treatment will consist of the ordinary measures for inflammatory fever; having recourse to mercury as a probable means of preventing effusion and its damaging results in the delicate structure of the tympanum. Other, and more specific treatment will be appropriate, according to the constitutional character of the inflammation. Hence, in rheumatic otitis, colchicum and alkaline remedies should be resorted to.

*Chronic* inflammation requires more particular attention to the state of the general health. An apparently scrofulous character of the disease, may be overcome by a course of cod-liver oil, iron, and quinine; a rheumatic character, by iodide of potassium, or guaiacum, combined with tonics; a syphilitic taint, by similar treatment. Local measures—of comparatively subordinate importance—will, however, be rendered more necessary in any accession of inflammation; which must be combated by topical depletion and counter-irritation. Otorrhœal discharge should be washed out of the meatus by gently syringing with warm water: and applications made to the membrana tympani, according to its morbid condition. A thickened, opaque, appearance may be remedied by a mild stimulant solution of nitrate of silver,—two to four grains to an ounce of distilled water, or the dilute citrine ointment; applied once or twice a week, with a camel's-hair pencil. A dry tense state of the membrane, owing to the absence of wax, is in itself a source of great discomfort to the patient; this state may be much relieved by a little glycerine dropped into the meatus at bed-time; a substitute for the ceruminous secretion which was originally suggested by Mr. T. Wakley.

The consequences of otitis severally merit some special consideration.

*Caries* or *necrosis* of the mastoid or petrous portions of the temporal bone, is connected with suppuration within the mastoid cells or the tympanum. Persistent otorrhœal discharge of a fœtid character, abscess perhaps over the mastoid process or among the muscles of the neck, fungous granulations choking the meatus, and dead bone felt with the probe, constitute the more peculiar symptoms; deafness, and probably facial paralysis on the side affected, accompany the destruction of the internal ear.

Little can be done in this extremity beyond removing the dead portions of bone. Sir Philip Crampton drew from the meatus of a young lady a piece of bone comprising the entire internal ear,—vestibule, cochlea and semicircular canals, with a small bit of the inner wall of the tympanum. Urgent symptoms of inflammation of the brain with hemiplegia supervened, but she ultimately recovered with total deafness in the ear. Fœtid discharge must be washed away and corrected by appropriate injections.

*Inflammation of the dura mater*, with effusion of greenish yellow fibrine on, or abscess in, the brain, must be treated according to the directions already given in connexion with fracture of the skull.

*Perforation of the membrana tympani*—may be a consequence of otitis; or of violence, directly or indirectly applied; as by forcibly syringing or poking instruments into the meatus, the accidental introduction of foreign bodies, by loud noises, as the discharge of cannon, by descent in the diving-bell, by violent blowing of the nose and thereby forcing a current of air

through the Eustachian tube, and, by blows or boxes on the ear, or fracture of the petrous bone.

The *symptoms* are, a sense of shock in the ear as if something had given way, bleeding from the meatus, and immediate deafness, more or less complete, according to the size of the aperture. During the act of swallowing, the patient may be conscious of air escaping through the meatus, or he tastes in his throat, substances applied within this passage. Examination with the ear-speculum shows the aperture in the membrane, throwing a shadow perhaps on the tympanum beyond; and if the patient inflate the tympanum through the Eustachian tube, air-bubbles and mucus issue from it.

*Treatment.*—Any inflammatory symptoms consequent on perforation or rupture of the membrana tympani must be subdued, as by the treatment of otitis. Perforation may sometimes itself be closed, by lightly touching the membrane with a blunt probe coated with nitrate of silver.

*Artificial membrana tympani* is a very simple contrivance, for the closure of an aperture indisposed to heal, or of large size; and thus restoring the tympanum and power of hearing. It had long been known that a drop of water or oil put into the ear, enabled a patient to hear, whose tympanic membrane was ruptured; a thin film of the fluid closing up the aperture. Mr. Yearsley, therefore, proposed in 1848, a simple but effectual substitute for the lost membrane—a small piece of cotton-wool moistened with oil or glycerine, introduced through the meatus and applied, by means of a fine probe, against the orifice. Patients can easily be taught to do this for themselves. The cotton is renewed once or twice daily, as occasion requires. Instead of cotton-wool, Mr. Toynbee used another kind of artificial membrane, in the shape of an oval piece of thin India-rubber.

*Collapse of the Membrana Tympani.*—A depression of the membrane inwards, presenting the handle of the malleus unnaturally prominent. Usually a consequence of chronic otitis, the membrane is thickened and opaque; but sometimes it retains its natural appearance. In the latter condition it is said that the patient can hear better during a noise, or when stimulated by a few drops of nitric ether dropped into the meatus. Any contrivance for drawing the membrane outwards seems hopeless.

*EUSTACHIAN TUBES.*—*Throat Deafness.*—The Eustachian tube connecting the cavity of the tympanum and the throat, allows air to enter and escape from that cavity, when necessary. The tubes are not constantly open, but only during the act of swallowing. In this act, Mr. Toynbee showed that the levator and tensor palati muscles open the guttural orifice of the tube, thus affording free egress to the mucus from the living membrane of the tympanum, and allowing air to enter or leave the tympanic cavity.

Inflammation and thickening of the lining membrane of the Eustachian tube, precludes this communication between the tympanum and throat. Hence, ringing and crackling noises in the ear during swallowing or blowing the nose, from the bursting of mucous bubbles. Similar sounds may be heard by the Surgeon through the *otoscope*.

This instrument, as improved by Mr. Harvey, is a flexible stethoscope; one end of which, expanded into a hollow ball, is put over the patient's ear, while the other end is applied to the Surgeon's. Then, if the patient close his nose and mouth, and make the effort to swallow or blow the nose, the tympanum should become inflated; when, therefore



the Eustachian tube is pervious, the Surgeon will hear the impulse of air against the *membrana tympani*; but if the tube contains mucus, he will hear a gurgling or some other noise, and if it be impervious, no sound will be elicited. This experiment should be tried more than once, in evidence of the state of the tube. Swollen tonsils, and a generally relaxed state of the mucous membrane of the fauces and nose, accompany throat-deafness. It arises usually from cold.

*Treatment.*—Astringent gargles, and blistering behind the ears, must be reinforced by a course of iron, quinine, and a generally tonic plan of treatment. The state of the digestive organs should not be overlooked. Mild mercurials, as the *hyd. c. cretâ*, or combined with sudorifics, as in Dover's powder, will sometimes prove singularly efficacious in clearing off an obstinately congested condition of the mucous membrane, with a vitiated secretion. *Removal of the tonsils* and uvula, has been considered curative. But enlargement of the tonsils is not the cause of throat-deafness, and their free removal may seriously affect the voice, the general health, and perhaps the development of the generative organs. Excision of the superficial portion of these bodies may be advisable to facilitate swallowing. *Catheterism* of the Eustachian tube has been proposed with a view of effecting dilatation. Much diversity of opinion might be mentioned respecting this operation; but the balance of evidence is adverse to its efficacy. If deemed advisable, it can be accomplished by introducing a probe, slightly bent at its distal end, along the floor of the nostril, with its point downwards; on the instrument reaching the end of the nasal fossa—the posterior margin of the hard palate, which may be known by its point suddenly dipping down, it should be directed outwards and backwards, when it will readily enter the pharyngeal orifice of the tube. In continuing the probe onwards through the tube, the operation is not altogether without peril; whether in relation to the slender, bony, partition between the tube and carotid canal, or that of the tympanic cavity and cranium, or to the jugular fossa. *Perforation* of the *membrana tympani* has also been proposed as another mode of cure; thus allowing access of air to the tympanum, when the natural communication through the Eustachian tube is impervious. This operation is as little favourable as catheterism, though less hazardous.

**EAR-ACHE.**—**OTALGIA**—Properly speaking, a neuralgic pain of the ear, is distinguished from the ear-ache of otitis by its sudden intensity and paroxysmal character. The causes are those of neuralgia; though, perhaps, the affection may be referable to some local source of irritation, especially carious teeth.

The *treatment* consists in purgatives and quinine, and removal of any carious teeth. Relief is sometimes afforded by the application of tincture of aconite behind the ear.

**DEAFNESS.**—This functional defect has already been noticed as a symptom of inflammatory and other diseases, in various parts of the auditory apparatus. Functional disorder of the auditory nerve is also an imputed cause of the loss of the sense of hearing. Mr. Toynbee, however, has shown that such supposed nervous deafness, even in old people, usually depends on some chronic form of inflammation of the lining membrane of the tympanum. Organic changes in the auditory portion of the brain itself, possibly, complete the parallel between nervous deafness and amaurosis.

*Treatment* in both diseases has a very restricted remedial influence.

## CHAPTER XLII.

## INJURIES AND DISEASES OF THE NOSE.

INJURIES.—(1) *Foreign Bodies* are sometimes thrust into the nostrils of children in play. Pearl buttons, pebbles, peas, or other small bodies, may thus be lodged a little way within the nares, and easily seen or discovered by slightly dilating the nostril with a nasal speculum. (Fig. 330.) Extraction can generally be accomplished by an ear-scoop, or a bent probe, or with the polypus forceps. Failing to remove the body through the nostril, it must be pushed back into the throat.

FIG. 330.

(2) *Epistaxis*, or bleeding from the nose, may in common with other hæmorrhages, be the effect of injury, or induced by some state of the circulation, or of the blood itself; determination of blood to the head in a plethoric subject producing *active* hæmorrhage of arterial blood; disease of the heart opposing the return of venous blood, or the altered state of the blood in scurvy, purpura, and other diseases, producing *passive* hæmorrhage.

In young persons, epistaxis is rarely a formidable hæmorrhage, though I have seen such severe recurring bleeding from fracture of the nasal bones—a broken nose, in a powerful policeman, as well-nigh proved fatal. In elderly and enfeebled persons, epistaxis is often perilous.

*Treatment*.—Slight epistaxis, in young and healthy subjects, may be arrested, when necessary, by sluicing the nose and forehead with cold water, or by cold applied to the nape of the neck; and any tendency to its return prevented by purgatives and emmenagogues. In plethoric persons, to whom epistaxis often acts as a safety-valve, the bleeding should not be indiscriminately checked. Cold, rest, and dry-cupping from the back of the neck, sometimes, however, become requisite, these measures being reinforced by saline purgatives. *Passive* hæmorrhage is best controlled by styptics, administered internally and applied within the nostrils. Gallic acid, in five or ten grain doses, is perhaps the most efficient; and the anterior nares may be plugged with a compress of lint or sponge soaked in a solution of alum, perchloride of iron, or tannin. Any concurrent disease, as the cause of hæmorrhage, must of course be treated. A scorbutic condition often yields to the administration of oil of turpentine.

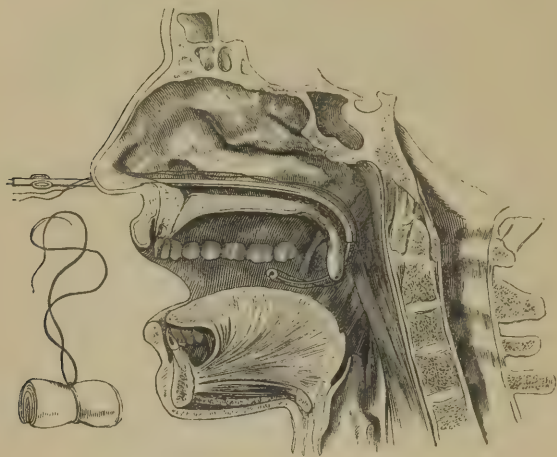


Severe or persistent epistaxis, or as arising from injury, can sometimes be arrested by elevating the arm to a vertical position on the side corresponding to the hæmorrhage; or both arms when the bleeding is from both nostrils. Malgaigne, in his work on Fractures, mentions a remarkable case of copious epistaxis produced by fracture of the nose in the person of a young man who had been thrown down with his face to the ground. Cold lotions having failed to check the hæmorrhage, he was directed to raise his arm perpendicularly; it ceased immediately, and did not recur.

But severe or persistent epistaxis will generally require the simple operative procedure of plugging the posterior nares, as well as the anterior.

*Plugging the Nares.*—This is most readily accomplished by passing an elastic catheter, armed with a long piece of strong whipcord fastened to its eye end, along the floor of the nasal fossa, through the posterior nares into the pharynx (Fig. 331); then seizing the cord with forceps as

FIG. 331.



it appears behind the soft palate, it is drawn forwards through the mouth, while the catheter is withdrawn from the nostril. The cord, thus passing round the back of the soft palate, hangs out of the mouth and nose. An oblong plug of lint or compressed sponge of sufficient size to

FIG. 332.



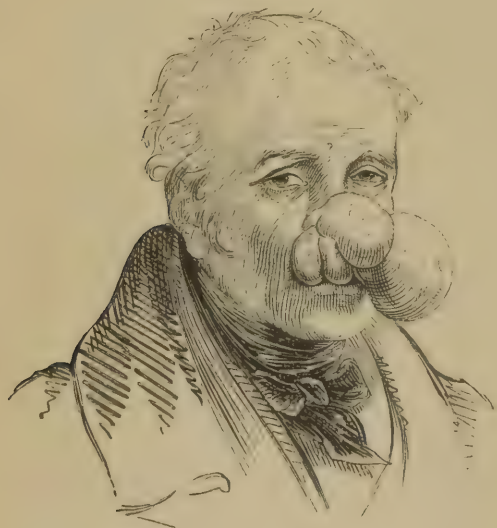
occupy the posterior nares, is firmly tied to the cord as it hangs from the mouth, and by pulling the cord through the nose, the plug is drawn back into the posterior nares. (Fig. 332.) The anterior nares is then plugged with compresses of lint or sponge. When, on removing these compresses,



the bleeding has ceased, the posterior plug can be easily withdrawn by the end of cord which hangs from the mouth. Or the plug may be renewed—a fresh, clean, pledget—by means of the nasal end of the cord. Bellocq's sound has been used for introducing the cord, but this instrument may not be at hand; an elastic catheter is surely ready.

DISEASES.—(1) *Hypertrophy* or *Lipoma*.—An overgrowth of the cellular texture and skin of the nose sometimes occurs; presenting a large reddish-blue, lobulated, pedunculated, mass at the end of the nose, arising apparently from enlargement of the sebaceous follicles. (Fig. 333.)

FIG. 333.



This inconvenient and unsightly mass is of slow growth and not dangerous; but the monstrous deformity will compel the unhappy individual to seek relief. It occurs seldom before fifty years of age, and in a somewhat broken constitutional state of health.

Removal with the knife is the only remedy, and a tolerably easy one. An incision is made in the middle line of the nose, and the mass carefully dissected off the alar cartilages on either side, an assistant introducing his finger into the nostril to support the cartilage. The wound usually heals by granulation.

(2) *Cancer*, occasionally, affects the nose, in the form of scirrhus or encephaloid; but more often as epithelial cancer. These forms of growth present the same appearances as elsewhere. Treatment must be conducted in accordance with general principles.

(3) *Lupus*, or *noli me tangere*, seems to have a special affinity for the nose; it is an insidious and obstinate ulceration of the skin, and which produces frightful havoc, by the destruction of one or both alæ, the columna, or the whole of the organ. The diagnostic characters of *Lupus* and *Cancer*-ulcers are described in connexion with these diseases. If the disease be arrested and cicatrization ensues; the remnant nose then

appears truncated obliquely from above the nostrils, exhibiting two dark cavernous apertures with a thin-skinned reddish shining cicatrix—a hideous spectacle. The disease occurs mostly in fair delicate persons, during childhood or adolescence; and in both sexes indiscriminately. It seems to arise from, and be symptomatic of, some constitutional disorder of assimilation and nutrition.

The *treatment* medicinally and hygienic requires no special notice; restoration of the lost portion of the organ—by rhinoplastic operation, forms part of the PLASTIC-SURGERY OF THE FACE.

(4) *Syphilitic Ulcer* of the nose differs from the lupoid and cancerous forms of ulcer. It usually attacks the ala or the tip of the nose, and commences as a small pimple, red, hard, and somewhat painful, which suppurates and opens into an ulcer. Sometimes, the skin over the fibro-cartilages inflames and gives way, by a crack or fissure. Thus far there is nothing characteristic. But, the resulting ulcer has an irregular, fringed margin. The discharge is ichorous and encrusting; the ulcer, at the same time, eating away beneath. A faint blush surrounds the ulcer. These appearances must, however, be taken in connexion with other present or past manifestations of constitutional syphilis, to complete the diagnosis.

The *treatment* is that of secondary syphilis. Mr. Ure found iodide of potassium—when mercury had been previously given—most efficacious, in conjunction with a lotion of bichloride of mercury, a grain and a half to the ounce of water. Under this treatment, an ulcerated patch soon healed, which had extended from the ala to the tip of the nose, and which was of fifteen months' standing.

NASAL FOSSÆ.—(1) *Ozæna* or *Rhinorrhœa*.—A muco-purulent or sanious discharge, having a fœtid odour, yellowish or greenish colour, and coming from one or both nostrils. Proceeding from the mucous membrane lining the nasal fossæ—here named pituitary or Schneiderian membrane, this discharge is symptomatic of various ulcerations of that membrane, involving perhaps the bones forming the fossa. Thus may be recognised *Catarrhal Ozæna*, which sometimes accompanies chronic catarrh; *Scrofulous ozæna*; and *Syphilitic ozæna*. The diagnosis must be mainly determined by the concomitant and antecedent constitutional condition. Impaction of a foreign body in the nasal fossa will at length give rise to an ulcerative discharge. Injury to the nose is occasionally followed by *ozæna*. One of the worst cases of *ozæna* I ever saw; was the result of contusion of the bridge of the nose; apparently without any syphilitic taint or other constitutionally predisposing cause. The nose often has a broad and flattened appearance—the nez écrasé of French authors.

*Ozæna* commences in infancy or in adolescence, and in either case frequently lasts through life. It has been known to subside when menstruation is established, or after childbirth. But it is rarely cured, excepting at its outset, and that in young subjects.

*Treatment*.—Various stimulant and astringent applications may be used with advantage to modify the vitality of the pituitary membrane; such as very dilute solutions of nitrate of silver, sulphate of copper, and chloride of zinc. Professor Gross recommends an injection of three grains of tannin with a quarter of a grain of sulphate of copper to an ounce of distilled water. Deodorizing injections must be used to correct the stench; such are chlorinated solutions, and dilute solutions of creosote,

carbolic acid, or permanganate of potash. Trousseau extols the insufflation of calomel, conjoined with an injection of bichloride of mercury. In Ozæna which has persisted for a period of years, and is attended with superficial erosion of the mucous membrane; Mr. Ure has prescribed with advantage a liniment of fifteen grains of chloride of zinc and one ounce of olive oil; which is to be pencilled over the affected part, once a day. A peculiar caustic-holder has been devised by Cazenove for applying nitrate of silver in ozæna.

*Abscess, ulceration, caries and necrosis*, in the nasal fossæ, are all intimately connected with ozæna, and scarcely require a separate notice.

*Abscess* forms most frequently on the septum nasi; and is often associated with a scrofulous taint in the constitution; the presence of an exanthematous fever, as small-pox, measles, scarlatina; or with injury of the integument—a wound situated near the lower end of the nasal bones. The integument becomes œdematous and tender, the pituitary membrane inflamed throughout, and the portion covering the septum is uniformly turgid. Matter forms, and a prominent, red, shining, and fluctuating swelling—in one or both nostrils, obstructing the passage. Pain extends up the nose to the frontal sinuses, and the swelling enlarges downwards, protruding the upper lip. Abscess in both nostrils usually communicates through the septum. The *treatment* is simply that of any other abscess. An early incision, and so as to give free vent to the pus, affords great relief. The opening must be maintained, lest the matter reaccumulate. The discharge, at first sero-purulent, assumes a glairy consistence.

Chronic abscess of the septum is very insidious. Destruction of the bones, cartilages, or both, not uncommonly results, and even after apparent cure of the abscess.

*Ulcer* occurs in any part of the nasal fossa, but mostly at the angle of the ala and septum, or between the ala and tip. Any such ulcer is very painful and chronic. The *treatment* consists in the application of white precipitate ointment, an excellent remedy; or perhaps citrine ointment or nitrate of silver. General remedial measures must have regard to the constitutional condition.

*Caries and necrosis* may also affect any of the bones forming the nasal fossæ; but here again, the septum, more especially. The nasal bones participating, a marked flattening of the nose ensues, as the bridge sinks in the course of destruction. Such may be the result of syphilitic ozæna. The only special *treatment*, is the removal of the dead portions of bone with polypus-forceps.

(2) *Thickening of the Schneiderian Membrane*.—This state of the nasal mucous membrane not uncommonly occurs throughout the whole extent of the fossa, and in both nostrils; frequently the thickening or hypertrophy is limited to the portion of mucous membrane underneath the inferior spongy bone. But here the membrane is naturally thick, as Kölliker points out, owing to its glandular character and abundant, almost cavernous, venous plexuses.

*Symptoms*.—The affection causes uneasy breathing, especially during cold and damp weather; there is also perceptible swelling in the nostril, resembling polypus; but, it is of a deeper red colour—never grayish, and not pedunculated. It may also, unlike polypus, be situated on the septum nasi. These appearances were well-marked in a case which came under my notice many years ago; and in that instance the lower part of the



nose was bent to the side opposite to the thickening, thus exposing its characters more clearly.

Thickening of the membrane, as thus described, may arise spontaneously, or follow *chronic coryza*. This latter is an inflammatory affection of the Schneiderian membrane, in a chronic state, and distinguished by a thin, acrid, ichorous discharge from the nostrils. It may be catarrhal, or have a syphilitic or scrofulous constitutional origin.

*Treatment*.—The topical application of astringents, by means of the injections already noticed with reference to *ozæna*, will probably reduce chronic thickening of the membrane and restrain any coryzal discharge. But these measures must be supported by appropriate constitutional treatment, as also requisite in the various forms of *ozæna*.

(3) *Polypus*.—Tumours of very different kinds growing within the nostrils, are associated under the common term, nasal polypi. They agree only in being pedunculated, and as obstructing, more or less completely, the nasal passages. Their structural differences, and distinctive characters are as follow.

*Gelatinous* or *Mucous* polypus—the ordinary form of growth. This is a soft, pulpy, slightly elastic tumour, of a grayish brown colour, somewhat translucent, and lobulated, attached by a peduncle to the mucous membrane. It consists of the elements of this membrane, a fibro-cellular

FIG. 334.



texture covered with ciliated epithelium; it is slightly vascular, and more so at the root of the tumour. It is attached, commonly, to the middle spongy bone or middle meatus, extending perhaps an inch from before backwards (Fig. 334); sometimes growing from the other turbinate and ethmoid bones; occasionally from the roof of the nares, or even from the frontal sinuses or antrum; never from the septum. More than one polypus usually forms at the same time; and, several co-existing, each has a distinct peduncular attachment. But the lowest or

most anterior readily presents downwards in the open nostril, while the others are concealed and compressed; one overlaying another or others, like toadstools in their growth. Polypi may form in both nares simultaneously.

The growth increases in size rather slowly and gradually, restricted, probably, by the osseous boundaries of the nares. Occupying, and more or less completely blocking-up the passage, the tumour may come forwards to and through the nostril, or extend backwards over the soft palate to the fauces, and hang down into the pharynx. The bones and cartilages seldom become diseased, but displaced; thus enlarging the nasal fossa, and resulting in considerable expansion of the nose. Having a succulent character, owing to its cellular structure, this species of polypus is hygro-metric; diminishing in dry, warm, weather, and increasing and becoming plump, or even protruding, in moist weather. It may occur at any period of life, but is most common in adults.

The *symptoms* are, a sense of stuffing in the nostril, as if proceeding from a constant cold in the head, and which varies with the state of the

weather. A thin mucous discharge from the nose, and fits of sneezing, complete the illusion. Respiration through the nares becomes embarrassed more and more, the patient breathing with his mouth open, and sleeping thus with his head thrown back, snoring loudly. The voice acquires a nasal twang, is indistinct and snuffling; and the special senses, connected with surrounding organs, become affected by the polypoid growth. Smell and taste are impaired or lost. Deafness ensues, due, as Mr. Toynbee states, to a co-existent thickening of the membrana tympani. In addition to symptoms, certain *phenomena* may be elicited. On stopping the free or partially-free nostril, by pressing that side of the nose with the finger, the patient cannot breathe through the affected nostril, or imperfectly, the air being expressed by a forcible effort, with a whizzing or singing sound. The patient then feels something shifting its place to and fro in the nasal cavity, and the Surgeon hears a peculiar noise, like, as Dupuytren compared it, to the flapping of a flag. Sometimes the polypus thus descends into sight. On directing the patient's head backwards, the polypus will be seen, or brought into view by dilating the nostril a little with a bivalve nasal speculum; and the tumour is observed to have the characteristic appearances already mentioned. Ultimately, the nose acquires a peculiar broad, laterally dilated, or *frog-faced* aspect; giving a singularly heavy, stupid, expression to the upper part of the face. (Fig. 335.)

FIG. 335.



*Diagnosis.*—Gelatinous polypus must be distinguished from common catarrhal coryza, from thickening of the mucous membrane covering the middle spongy bone, from displacement of the septum to one side, from abscess of the septum, and from an extraneous body, as a fruit-stone or a nasal calculus. Certain other polypoid growths are also liable to form in the nasal fossa, but these may be diagnosed chiefly by their special characters.

*Fibrous polypus* presents a firm resistant tumour, instead of a soft, elastic, substance like an oyster; and which does not vary in size with hygrometric changes. It is more broadly pedunculated, and springs from the periosteum beneath the mucous membrane. Its structure is essentially fibrous, and much more vascular than gelatinous polypus. Sometimes, according to H. Cloquet, it becomes encrusted with phosphate of lime, and partially ossified. It may spring from the septum, and is usually solitary.

This species of polypus grows more rapidly, attains a larger size, and, owing to its higher vascularity, has a greater tendency to bleed. Increasing in size, the tumour causes greater displacement of the surrounding bones in the nasal fossa—as deviation of the septum, depression of the palate, projection of the nasal bones; or it extends backwards and is prolonged into the pharynx. It is also apt to send offsets into the various sinuses, in the frontal, ethmoid, and superior maxillary bones, thus appearing in situations where little expected, as in the pterygo-maxillary fossa, or in the orbit through an aperture formed in its inner wall.

All the *symptoms* due to the presence of a tumour in the nasal fossa, are much more aggravated.

*Malignant or Cancerous Polypus*.—This, the third species of polypoid growth, is a soft tumour, of a deep red or dark purple colour, prone to bleed, and painful; fixed to the bone, and springing, perhaps, from a greater depth, within the cranial or sphenoidal cells. The nasal portion may be only the external protrusion of a deep-seated medullary tumour. Growing rapidly, with great expansion of the nostril, it tends to protrude through the nasal or lachrymal bones, and frequently displaces the eye. It discharges a fœtid, bloody, ichorous fluid; while repeated hæmorrhage, and acute, lancinating pains, striking up into the root of the nose and forehead, accompany the development of this species of polypus, and reduce the patient's strength to the last extremity. The disease occurs only in adults or in advanced life.

TREATMENT.—The three species of polypus, above described and contrasted, are incurable by any known medicinal treatment, whether local or constitutional. Removal by operation is the only resource, but the different species of tumour are thus removable with very different degrees of facility, and probability of non-recurrence.

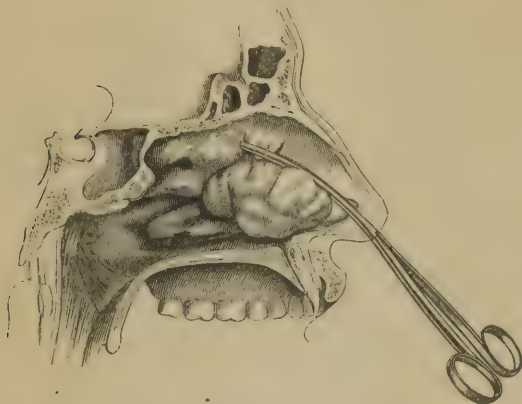
*Gelatinous* polypus, very rarely, may separate, and is expelled *spontaneously*; and its ejection has been known to happen, after the repeated application of strong stimulant injections, by sloughing of the tumour. But this would be an uncertain and incomplete result, and probably followed by recurrence of the growth.

This species of polypus is, usually, extracted with *forceps*, by a combined movement of pulling and twisting. Forceps having rather long, serrated blades, to hold securely—nasal polypus-forceps, are used for the extraction, the instrument being made of sufficient length, slender, and straight, or slightly curved, according to the situation of the polypus. The neck of the polypus is first clearly ascertained by running a probe round the tumour, above and below the middle spongy bone, or its peduncular attachment elsewhere. Then—the patient sitting facing the light—the Surgeon standing in front, elevates the tip of the nose with his thumb to gain as good a view as possible of the polypus; he introduces the forceps closed into the nostril, and approaching the peduncle, opens the blades just sufficiently to slide one above and the other below, and



securely grasps the peduncle. (Fig. 336.) A little movement of the hand will convey the feeling of attachment, while the soft, yielding, texture of the polypoid peduncle, in closing the blades of the forceps, further gives assurance that the spongy bone, a crackling texture, has not been seized. By a gentle pull and jerking twist with the instrument, the

FIG. 336.



polypus is detached and withdrawn from the nostril. Several polypi may successively be removed in like manner, care having been taken to distinctly feel the peduncular attachment before attempting to remove the growth.

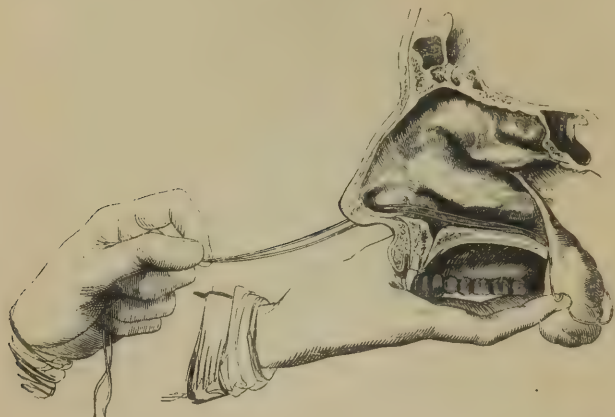
This method of extraction is attended with considerable pain, and not inconsiderable hæmorrhage; the latter often compelling the Surgeon to postpone any further removal of the polypi, to a second and a third sitting. Moreover, with due precaution in tearing away a gelatinous polypus, its soft consistence yields, and the tumour is apt to come away piecemeal; or the delicate spongy bone or other basis of mucous attachment is liable to be injured, and it has even been urged that the separation of a small scale of bone with the peduncle will more effectually prevent the recurrence of the growth. This is obviously a pathological error respecting the nature of the ordinary mucous or gelatinous form of polypus; and any extraction of bone should be regarded as a misadventure in the operation which will probably be followed by caries of the exposed osseous surface.

Having regard to all these considerations, the practical importance of which I had often experienced, I, some years since, devised a forceps which cuts and holds the peduncle. The "*polypus scissor-forceps*," as this instrument is named, combines scissors and rasped forceps, one edge of either blade being that of an ordinary scissors, the other broad and rasped. This instrument is, in fact, an adaptation of the grape or flower-scissors, commonly used in conservatories. By means of the scissor-forceps, I have removed nasal polypi in a large number of cases, with comparatively little pain and hæmorrhage; and never, so far as I have been able to ascertain, has there been any return of the growth.

*Ligature* is chiefly appropriate when polypus passes through the posterior nares, and hangs down in the pharynx—naso-pharyngeal polypus.

The object of the operation by ligature is to accomplish strangulation, and thence separation of the polypus in the form of a slough. Accordingly, a loop of firm whipcord, catgut, or silver-wire, is passed through the nostril into the pharynx, and expanded under the polypus, and drawn up around the peduncle, this noosing procedure being aided by introducing the forefinger into the mouth. (Fig. 337.) The ends of the cord, at the

FIG. 337.



nostrils, are passed through a slender, double, canula (Fig. 338), which is then slid along upon them through the nares to the polypus, when, by tightening and securing the ends of cord to the rings at the nasal extremity of the canula, the peduncle of the polypus is strangled. The canula may be introduced threaded with the whipcord, if this seem to be a more easy way of passing the loop. The cord must be tightened, through the canula, from day to day, until separation of the tumour is effected. Sir W. Fergusson recommends separating the tumour at once, when this can be safely done, rather than allowing it to slough away. In either modification of this operation, care must be taken, lest the tumour drop into the lower part of the pharynx or over the larynx, and cause suffocation; and during the process of sloughing separation, the head should be inclined forwards to avoid the risk of fatal systemic infection from the morbid secretion, a result which has actually occurred.

Occasionally, it may be necessary to slit up the ala of the nostril, at its junction with the cheek, in order to gain access to the root of the tumour.

A button-hole-like incision in the soft palate has been resorted to by Maissonneuve, so as to draw the polypus through the opening into the mouth, where it can be ligatured or cut off with the knife. The direction of the button-hole is from before backwards, and the great elasticity of the soft palate readily allows the polypus to pass through a comparatively small opening, which also generally closes without the aid of suture. This procedure—the *bouttonnière palatine*, has yielded the most satisfactory results in the hands of M. Maissonneuve.

A general clearance of the nares has been effected by drawing a plug from behind forwards—a brushing mode of extraction, suggested, I believe, by Dr. McRuer, an American physician, who highly extols it. A

piece of catgut is introduced through the nostrils into the mouth, to which is fastened a piece of soft and dry sponge, corresponding in size, when firmly compressed, to the narrowest part of the nasal passage; it is then drawn gently forwards through the nose. In at least ten cases, all the adventitious growths were thus brought away.

*Fibrous* polypus may, perhaps, be extracted with forceps, or tied when pedunculate. Excision has succeeded in broader-based and larger-sized polypi of this kind.

*Cancerous* polypus is perfectly irremediable and uncontrollable by any surgical proceeding.

**TUMOURS OF THE SEPTUM.**—Besides abscess of the septum, presenting its characteristic swelling as already noticed; certain tumours, containing blood or of a cartilaginous consistence, are liable to form in the septum nasi. The *bloody tumour* is always the result of injury, and has the appearances of ecchymosis in other parts of the body. Absorption of the extravasated blood should be promoted; incision is rarely necessary. *Cartilaginous tumour* is very uncommon. Mr. Ure met with one such case, and wherein he effected a cure by excision; the junction of the ala of the nose with the cheek having been slit up, in order to make room for the application of a gouge to remove the tumour. A *gelatinous tumour*, of uncertain nature, sometimes forms in the septum. It may be obliterated by snipping away a portion of the wall, and cauterizing the interior with nitrate of silver.

*Calculi or Rhinoliths.*—Calcareous concretions occasionally form in the nasal cavities; usually in the lower meatus, or they may originate in the frontal sinus or in the maxillary sinus, and thence pass into the nostril. They vary in size from a date to a hazel nut, or may completely block up the nares, and produce deviation or partial destruction of the septum. They present an uneven surface, and are of a black, gray, or white aspect. Sometimes single, in other cases multiple; nasal calculi consist of phosphate and carbonate of lime, magnesia, and mucus; resembling other concretions. The nucleus may be an extraneous body, as a cherry-stone, or portion of a tooth. The cause of these concretions is obscure, probably chronic inflammation of the Schneiderian mucous membrane. The *treatment* will, obviously, be the extraction of such bodies by suitable forceps or scoop; and then to allay irritation.

**CLOSURE OF THE NOSTRILS** may be congenital, or acquired as the result of inflammatory constriction or adhesion. The ala of the nose may thus be joined to the septum in consequence of ulceration. Any such impediment to respiration and speech, can, perhaps, be overcome by dilatation with tents, gradually increased in size; or it will be remediable by incision, followed by the use of tents, in the nostril.

**PLASTIC SURGERY OF THE NOSE**—or RHINOPLASTIC OPERATIONS.—Plastic or Reparative Surgery comprises all those Surgical operations which are designed and performed for the *repair* of deficiencies of structure,—whether resulting from injury, disease, or malformation. It thus repre-

FIG. 338.





sents a large division of Operative Surgery, contrasting with that which pertains to Operations for the *removal* of parts, as by Excision and Amputation.

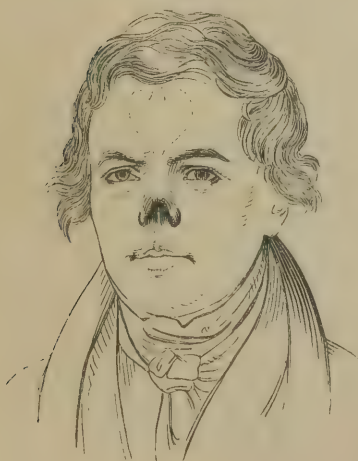
Plastic Surgery is well illustrated by rhinoplastic operations; the repair of structural deficiencies in this organ as the result of wounds, having almost given rise to all similar operations in respect to other organs; as principally exemplified by the operations for hare-lip, and cleft-palate, certain diseases of the eyelids, and of the organs of generation. Rhinoplastic operations are sometimes designated Tagliacotian operations, in honour of their originator, Gasparo Tagliacozzi, a celebrated Italian physician who flourished in Bologna, in the latter part of the sixteenth century. After his death, a marble statue was erected to his memory in the anatomical theatre at Bologna, with this insignia of his art—a nose—in his hand.

The entire nose, or a portion only, may require to be re-made; in consequence of destruction by disease or injury, or owing to congenital malformation.

(1) *Nose*.—Restoration of the entire nose may be accomplished by either of two plastic operations. In both the nose is re-made by borrowing a properly-devised flap of sound integument, and adapting it to the remnant organ,—itself in a sound state for its reception; but in one operation—that of Tagliacotius, the flap was taken from the inside of the arm; in the second or Indian operation, the flap is taken from the forehead at the root of the nose. The latter operation is now practised, exclusively. It was introduced into this country by Mr. Carpue, in 1814; who also improved the original proceeding by adding a septum nasi, and by the employment of sutures. He was soon followed in Germany by Gräfe and by Dieffenbach, and since by other Surgeons. In this country, the operation was more especially brought into practice by Mr. Liston, Sir W. Fergusson, and Mr. Skey.

*The Indian operation*.—This operation consists of three distinct procedures performed in succession,

FIG. 339.



at different periods, to complete the result. (1) The dissection of the flap from the forehead, and its attachment to the remnant nose; (2) the detachment of the root of the flap where it is twisted down from the forehead, and the formation of a proper bridge to the nose; (3) the formation of a columna nasi. The *flap* of integument is made thus:—a triangular piece of leather is cut into the shape requisite to form the *alæ* and apex of the nose, resembling the shape of the former nose. This outline model is laid upon the forehead with its base upwards, and its narrow peduncular part between the eyebrows at the root of the nose; and the outline is marked out on the skin with ink. (Fig. 339.) The

cicatrized remnant of the nose is then to be freely but carefully pared. The flap, as marked out on the forehead, must be dissected down; care being taken to make it of uniform thickness, but not to interfere with the periosteum or pericranium; and that the peduncular strip, at the root of the nose, be of sufficient length to allow of its being twisted round without affecting the circulation through it, as the channel through which the supply of blood to the flap alone depends. To facilitate this twist, the incision may be extended a little longer downwards on the side to which the flap is turned. Bleeding having ceased, the flap is brought round and its edges neatly adjusted to the pared margin of the remnant nose, and evenly fixed with sutures. The new nose is to be supported, not stuffed, with a little oiled lint; and wrapped in cotton wool to maintain the circulation. The edges of the wound in the forehead, corresponding to the peduncle, may be united with a suture; the rest of the surface healing by granulation, water-dressing should be applied.

In a few days the nose will have become plump and purplish red; but, this subsiding, union takes place and the organ becomes consolidated.

Then, the *twisted strip* of skin may be cut through, and adjusted evenly. To avoid a pucker, it may be necessary to excise a small portion.

The *columna nasi* is best restored by forming it out of the upper lip, as recommended by Mr. Liston, who practised this procedure with great success. First, the inner surface of the apex is pared. Then, a perpendicular strip is cut out of the centre of the upper lip, a quarter of an inch in breadth, and consisting of the whole thickness of the lip. The frænum having been divided by a touch with the bistoury, this strip of the lip is turned, not twisted up; the labial margin is thinly pared, and the raw surface adapted to that of the apex; the two are retained with a twisted suture, and the edges of the lip-wound brought together by two more such sutures. If troublesome bleeding occur from the coronary artery, one of these sutures should be so placed that the needle shall transfix the ends of the vessel.

During the process of complete restoration, the nostrils must be dilated occasionally, by introducing silver tubes up these passages. Eventually, the exposed mucous membrane of the raised strip of lip acquires a cutaneous character, while the interior of the nose resembles a mucous membrane and is moistened with a mucous secretion. Patients, who had previously been snuff-takers, have enjoyed a pinch of snuff, apparently with as much gusto as the oldest and most experienced nose could possibly have imparted. But even should our constructions fail in enabling a patient to resume a nasty habit, a nose is still a nose, "although there's nothing in't." (Fig. 340.)

FIG. 340.



(2) *Columna nasi*.—This portion of the nose may *alone* require restoration, in consequence of its separate destruction by disease involving the septum. The nostrils thus present one large gap, and the nose becoming depressed,—more so with destruction of the bones—great deformity results. The upper lip also, having lost the support of the columna, becomes pendulous, projecting, and thickened; augmenting the disfigurement. Restoration of the columna may be effected by the operation already noticed as supplementary to that for the nose; by means of a tongue taken from the middle of the upper lip.

(3) *Ala*.—When one ala only is deficient, a flap of integument, suitably shaped, may be raised from the cheek, and adjusted to the part, the edges of which have been previously pared, and retained there by a few points of suture. When both alæ are wanting, or if the cheek be thin, the flap had better be brought from the forehead. The connecting pedicle will necessarily be long and thin; and to maintain the vitality of the engrafted flap, a groove may be made in the dorsum of the nose to receive the pedicle.

(4) *Depressed Nose*.—Depression of the *apex*, or of the *bridge* of the nose, may severally occur; owing to the loss of the septal cartilage, or of the septum and nasal bones,—the fabric of the organ, although the external parts remain entire.

These defects may be remedied, by loosening the alar connexions of the nose, and drawing integument from the cheeks; thus raising the depressed portions of the organ, according to the proceeding of Larrey and Dieffenbach, who revived the operation of Celsus; or by the elevating operation of Sir W. Fergusson,—a simplified modification of that proceeding.

The point of a small scalpel, says Sir W. Fergusson, was introduced under the apex, and the alæ were separated from the parts underneath; the knife was carried on each side between the skin and the bones, as far as the infra-orbital foramen, taking care not to interfere with the nerves; when, by passing the point of my finger below the nose, I caused the latter organ to be as prominent as could be wished. I now passed a couple of long silver needles, which had been prepared for the purpose, with round heads and steel points, across from one cheek to the other, having previously applied on each side a small piece of sole-leather, perforated with holes at a proper distance; then I cut off the steel points, and with tweezers so twisted the end of each needle, as to cause the cheeks to come close to each other, and thus to render the nose prominent. Thus, by bringing the cheeks more into the mesial line, a new foundation, as it were, was given to the organ. Adhesion occurred in some places, granulation in others; in the lapse of ten days the needles were withdrawn, and in the course of a few weeks, when cicatrization was complete, the nose presented as favourable an appearance as could reasonably have been desired.

In all these *opérations de convenance*, and of very uncertain result, “let it”—as Mr. Skey advises—“be the patient who urges the operation.” The responsibility will thus be divided. Sloughing of the new nose, took place in one of Mr. Liston’s early cases; in another, hæmorrhage occurred under the flap, on the ninth day, and more than a pint of blood was lost; while, two patients out of six died, on whom Dieffenbach operated, owing probably to an unfavourable state of constitution.

THE FRONTAL SINUSES are subject to certain diseases not peculiar to



these osseous cavities, but originating in them as the seat of disease. *Abscess* forms occasionally, within the frontal sinuses, accompanied with great pain, of a dull, heavy, aching character; and subsequently expansion of the cavity, followed possibly by caries, and symptoms of inflammation extending to the membranes of the brain. Warm fomentations and other palliative measures may be employed in the first instance; but evacuation of the matter formed will probably become advisable. This would be done by trephining the anterior wall of the sinus, using a small trephine. *Polypus*, of malignant character, springing from within the sinus and expanding the cavity, might perhaps be treated in like manner; the trephine, however, being applied with the view of making an aperture for extirpating the tumour.

## CHAPTER XLIII.

## INJURIES AND DISEASES OF THE MOUTH.

**THE LIPS**—*Wounds* of the lips differ in no way from these lesions in general, excepting the liability of excessive hæmorrhage, compared with the extent of injury, when the coronary artery is divided. The vessel will have to be secured by means of a twisted suture, as for hare-lip; and care must be taken that the needle which brings the surfaces together, shall transfix the lip on either side, so as to command the cut ends of the artery beneath the mucous membrane. It is the arrest of hæmorrhage by acupressure. Otherwise, the blood collecting within the mouth may be swallowed, and thus large quantities of blood have been lost imperceptibly to the Surgeon.

**HARE-LIP.**—This deformity is a congenital fissure of the upper lip, from arrest of development. It is usually situated a little to the left side of the middle line of the lip below the nostril; occasionally, on the right

FIG. 341.



side; in either case forming *single* hare-lip. (Fig. 341.) Two such fissures may be present, one on either side, the central and intervening portion of the lip projecting as a short rounded process; forming *double* hare-lip. (Fig. 342.) In connexion with this latter deformity of the lip, the median portion of the

FIG. 342.



superior maxillary bones, which contains the two front incisor teeth, and which constitutes a distinct bone in the human embryo and in the lower vertebrata—the inter-maxillary or pre-maxillary bone, may be disconnected on one or both sides and project forwards, or depend from the septum narium, as a snout. Fissure of the bony or hard palate or of the soft palate, cleft palate, not unfrequently co-exists with hare-lip; and the median gap in the alveolus, just noticed, may extend backwards into a fissure of the palate. Cleft palate, however, frequently exists without hare-lip.

No particular functional inconvenience attends this deformity, but extensive hare-lip, interferes with the infant's power of suckling.

*Treatment.*—The age for operation—to remedy this congenital defect—has been the subject of much difference of opinion among some of the best Surgeons. There have been successful results at all ages; from a few hours after birth, a few days, weeks, or months, or at a later period, not until after the commencement of dentition. Having regard to the strength of the child, and that no unfavourable condition ensues from some delay; a month or six weeks will probably be about the proper time for operation.

*Operation.*—The child having been swathed in a large towel or piece of sheeting, thus completely securing the hands and feet, it is laid in the nurse's lap, so that the head of the infant shall be secured between the Surgeon's knees. Chloroform may of course be administered, but even then the position of the child, as described, will much facilitate the operative proceedings. Taking the lower corner of one side of the fissure between the thumb and finger and pulling forward the lip on the stretch, the Surgeon just divides the frænum with a straight and narrow bistoury, so as to free the lip; entering the point of the knife at the apex of the fissure, and carrying it forwards to the margin of the lip, the edge of the fissure is pared on that side, and then on the other side, held in like manner; care being taken that the whole thickness of the lip is pared. (Fig. 343). The pared edges are brought together and evenly adjusted, and secured by one or two twisted sutures. (Fig. 344.) The hare-lip pin

FIG. 343.

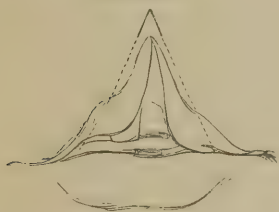
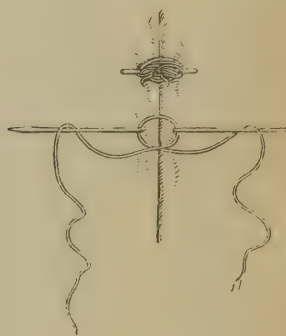


FIG. 344.



should be entered from one-third to half of an inch from the cut edges, and passed deeply, to about two-thirds, through the substance of the lip, on either side of the fissure. A strong silk thread is twisted round the projecting ends of the pin, over the lip, in the form of a figure of eight. The point of the pin is snipped off with small cutting-pliers, the head of the pin remaining on the other side. A second suture is applied in like manner. It is most important to observe that the line of continuity of the labial margin be maintained, and that there be no angular puckering at the apex of the fissure. No dressing is required.

Certain little modifications of this operation are urged by some Surgeons of experience. Thus, Mr. Skey recommends a slight excurvation of the incision in paring the edges of the fissure; to preserve the form of the lip, which is otherwise liable to be affected by retraction of the cicatrix. When inequality of the fissure exists, Mr. Lloyd was in the habit of preserving a small slip of the flap of the long half of the lip, and of attaching it to the under surface of the shorter half, that there might be no notch or fissure remaining after cicatrization. Mr. Holmes Coote

prefers two fine silver sutures, one at the angle of the fissure and the other at the red of the lip, instead of a second hare-lip pin; the former, it is alleged, holding these parts more immovably in contact.

The time for withdrawing the pins, is, usually, about the fourth day; or the labial one may be left for a day or two longer. The pin must be gently withdrawn, and the twisted thread caked with the oozed blood, should still be left undisturbed on the lip, to which it adheres as a plaster. If this precaution be taken for some days longer, there will scarcely be any necessity that the recently united wound should be supported by "adhesive strapping," or for the use of the spring cheek-compressor devised by Mr. Hainsby. (Fig. 345.)

Fig. 345.



Simple sutures—without the steady support of pins—are in favour with some Surgeons. Mr. Erichsen has treated hare-lip, double and single, in this way, for many years, and most successfully. He, however, restricts the eligibility of this modification of the treatment to cases, unconnected with very wide fissure in the palate, or great inter-maxillary projection. Under these circumstances the pins are preferable.

*Double hare-lip*, without malformation of the upper jaw, is treated on a similar principle. If the central lobe between the fissures be of full breadth and length down to the prolabium, the margins of both fissures should be pared independently, and united separately; but if the central portion be short and rounded, it should be sliced to a point downwards and the pared margins of the lip united, embracing this little V-shaped piece above and coming into contact with each other below. (Fig. 346.) In both cases, the same needles are sufficient to retain the two fissures, by transfixing the central lobe; the threads are wound round as before. Both fissures may be pared and treated thus simultaneously; or at separate periods, in order, it is said, not unnecessarily to increase the chances of failure.

Fig. 346.



The median—inter-maxillary, portion of bone, containing the two front incisor teeth, which not unfrequently complicates double hare-lip, must be dealt with when it projects so as to prevent union of the wound. The projecting portion may be removed with cutting-pliers; or it can generally be made to recede by gentle pressure, in the course of a few weeks—this plan of treatment having the obvious advantage of preserving the incisor teeth. It was strongly advocated by Sir A. Cooper, and is



now generally in favour. Pressure can be applied effectually by means of a spring-truss, worn several hours daily, until the portion of bone is sufficiently depressed to allow the lip to be brought over it into easy apposition.

M. Genzoul seizes the projecting portion of bone, with strong forceps, partially breaks and forces it into the perpendicular; and this immediate mode of replacement has proved successful. If the piece is connected to a perfect septum nasi, it will probably be necessary to remove a triangular bit, base downwards, out of the latter, before attempting to press back the projection.

*Congenital Transverse Fissures of the Cheeks*, extending from the angle of the mouth to the anterior border of the masseter muscle, or up towards the malar bone. Such fissures are rare. They must be treated on the same principle as hare-lip; their edges being pared and brought together by pins and twisted sutures, that union by adhesion may close the fissure.

*Congenital Contraction of the Orifice of the Mouth*, or even complete closure at birth, may be found, as in the nostrils. This condition will tax the ingenuity of the Surgeon to overcome by dilatation, or suitable incisions. The cut edges of skin and mucous membrane should be united by suture.

**CHEILOPLASTIC OPERATIONS.**—Restoration of either the Upper or the Lower Lip may be effected by plastic operations, varying in their design according to the deficiency of structure.

(1) The *Lower Lip*, partially destroyed by disease or injury, admits of restoration from the cheeks, which readily supply both skin and mucous membrane.

The *Celsian* operation, as described by Malgaigne and put into practice by the late M. Bonnet, of Lyons, is simply this:—The affected part of the lip, as in the case of cancer, having been removed by a **V**-shaped incision, or by two vertical incisions down to the base of the jaw, united by a transverse incision; the cheiloplastic operation of restoration will vary accordingly.

When a *triangular* portion of the lip and chin has been removed, this deficiency may be repaired by a transverse incision from the angle of the mouth, on each side, into the cheek, thus completing the boundaries of two triangular flaps. The margins of the **V**-shaped incision are then united by suture; while any portion of the upper border which may not be required for the formation of the new lip, from out of the cheek, is united to the part with which it is in contact. The mucous membrane in the mouth should be united to the skin by fine sutures. When the loss of substance is *quadrilateral*, two other incisions, parallel to the two prolonging the angles of the mouth, must be made along the base of the jaw. The two quadrilateral flaps, thus marked out, are then dissected from the bone, and brought forward, union in the middle line being obtained by sutures, as in the former operation.

Mr. Syme's operation consists in removing the cancerous ulcer by a large **V** or triangular incision, extending from the angles of the mouth to the chin. The apex is then the starting-point of an incision on each side, obliquely downwards and outwards, *under* the body of the jaw, and terminating in a slight curve outwards and upwards. The flaps, thus indicated, are dissected outwards, and raised upwards, until the original triangular incision comes into a horizontal line, forming the margin of the new lip, the secondary incisions under the jaw coming together in a

vertical direction, where they are retained by twisted and interrupted sutures.\*

Dr. Buchanan of Glasgow, in 1841, had devised a similar operation :—The diseased portion of lip having been removed by an *elliptical* incision, extending from angle to angle of the mouth, an incision is then carried downwards and outwards to the chin, on each side; and from these points an incision is made upwards and outwards, on each side, on the body of the jaw, parallel to and corresponding in length to the elliptical incision below the lip. The flaps, having been dissected, are raised to a horizontal line, and the secondary incisions united, as before.

This operative procedure may surpass Syme's, when the incisions are required to meet the removal of a large, elliptical-shaped, portion of substance, comprising the whole lip from side to side; but it will, otherwise, be desirable to have the incisions as little on the face as possible. All these plans of cheiloplastic operation for the lower lip are, however, superior to that of Chopart's operation, whereby the flaps of integument were raised from below the jaw, even as low down as to the hyoid bone.

(2) The *Upper* lip less frequently requires restoration, its structure being comparatively seldom the seat of cancer-growth.

Shrinking of the upper lip sometimes ensues from profuse salivation, by which this part is tightly stretched over the alveolar arch, and perhaps adherent to the gums.

Von Ammon rectifies this condition by the following plastic operation :—The lip is first detached from the gum, then an incision is carried upwards from the angle of the mouth, for about an inch and a half, towards the ala nasi. The tense parts separate, and this longitudinal fissure assumes a triangular shape. A flap of integument is dissected from the cheek, and brought down to occupy the space at the angle of the mouth. Precisely the same operation is performed on the opposite side.

The *central* part of the lip may be destroyed, and the two adjoining portions become drawn up towards the septum and alæ nasi, exposing the incisor teeth.

Dieffenbach rectified this deformity by bringing a sufficient amount of integument from the adjacent substance of the cheeks, on each side. An incision by the side of the alæ nasi, is carried round to the middle line of the lip, and down through its margin; each half is loosened, and brought together with twisted sutures.

DISEASES.—*Hypertrophy* of one or both lips sometimes accompanies the irritation of a crack or fissure, or it remains after the fissure has healed, and the source of irritation apparently has ceased. In the one condition, the fissure should be treated on ordinary principles, that the hypertrophied enlargement may subside; or, this remaining, an elliptical portion of the mucous membrane of the lip may be excised, and the wound united by sutures.

*Ulceration* of a simple character, though, perhaps, chronic, is liable to occur on any part of the labial mucous membrane; either as a result of the irritation of a sharp portion of tooth, or of a false tooth, or in connexion with a disordered state of the stomach and bowels. The treatment having reference to these causes, will be, to remove any source of irritation, oral or gastro-intestinal, and to touch the ulcer with nitrate of silver.

TUMOURS.—The *lower* lip is more commonly the seat of various forms of tumour.

\* Edin. Month. Journ. 1347.

*Encysted* tumour, small and semi-transparent, and containing a glairy fluid, resembles ranula in appearance, but that swelling is situated under the tongue. Excision of the cyst, by careful dissection, is the most certain cure; or snipping the cyst, and freely cauterizing its interior with nitrate of silver, may not be followed by a return of the tumour.

*Erectile* tumour of the lip admits of removal by excision, ligature, or strong cauterization. The size and situation of the growth will determine the choice of these modes of treatment.

*Epithelial Cancer*, affects the lower lip, very rarely the upper lip.

FIG. 347.



Commencing, as a small warty growth on the lip; or as an indolent tubercle; or as an excoriation of the mucous membrane, surrounded by an inflamed and thickened base; the disease is primarily situated in, or just beneath, the skin or mucous membrane, at or near the junction of the two in the red margin of the lip. Spreading thence, the wart grows in breadth and thickness, the tubercle peels and ulcerates, or the excoriation deepens. Eventually, the ordinary characters of epithelial cancer are presented. (Fig. 347.) The sub-maxillary glands become involved, and thence enlarged and indurated. The ravages of the disease, as it is seen to occur in other parts, may here also ensue; ulceration destroying the lip, and the lower jaw-bone and teeth becoming carious.

Pain, and discharge sometimes wear down the patient.

The diagnosis from *chancre* of the lip, is mainly determined by the latter presenting a superficial ulcer, raised on a base of cartilaginous hardness; the sore may cicatrize, and the indurated base remain. The sub-maxillary glands enlarge at an early period, six or eight weeks after the sore commenced. Secondary symptoms appear sooner or later, unless early treatment has been adopted. The upper or lower lip may be equally often the seat of chancre. Cancer of the lip occurs almost exclusively in men, and after the middle period of life; in these two particulars also it probably differs from chancre.

The local and exciting cause of cancer, would seem to be some source of irritation; commonly the adhesive contact of a clay-pipe when not coated with sealing wax; or a sharp broken tooth.

*Treatment.*—*Excision*, free and early, is the only cure. Some affection of the sub-maxillary glands does not forbid this procedure; but they also should be extirpated. The incisions in the lip must be directed according to the line of disease. A V-shaped incision will best include the diseased portion when it extends downwards in the lip (see Fig. 347); a quadrilateral operation in other cases; or a more superficial semicircular sweep, when the disease extends along the lip. The lines of incision should be brought together with twisted sutures, as in the operation for hare-lip; a horizontal incision may be closed by simple sutures, uniting the opposed edges of skin and mucous membrane.

This operation sometimes proves permanently successful; but often the disease returns in from six months to two years. Excision should, however, be repeated, to prolong life.



*Plastic* operations, as already described, may be resorted to, for restoring portions of the lip which have been thus sacrificed.

Very rarely, other forms of cancer affect the lip, and more often, the upper lip.

THE CHEEKS.—*Wounds* of the cheeks offer nothing worthy of special notice, in respect to the nature of these lesions. They must be neatly united, by means of simple sutures or hare-lip pins and twisted suture.

*Salivary Fistula* is a perforation or division of the Stenonian duct of the parotid gland, whereby the saliva dribbles out on the cheek. This condition may result from wound of the cheek, sometimes in removing a tumour situated over the duct; or in consequence of abscess or ulcer of the cheek, implicating the duct. The fistulous aperture and trickling saliva are a source of great disfigurement and inconvenience.

*Treatment*.—The object is to restore the continuity of the duct, as the natural channel for conveying the saliva into the mouth; where it opens upon the inner surface of the cheek, by a small orifice, admitting only a very fine probe, opposite the crown of the second molar tooth of the upper jaw.

Recent salivary fistula may sometimes be closed by pressure alone, by means of a compress applied over the fistulous aperture in the cheek; the saliva resuming its natural course through the duct, which still remains open. I have thus cured a fistula of this kind, in two instances. In a more established condition, the edges of the external aperture should be pared and brought together, and then pressure applied. *Confirmed* salivary fistula, is probably attended with closure of the natural opening into the mouth. It will be necessary to form an artificial communication with the duct; and this may be done, either by passing a small seton from the inside of the cheek into the fistula, as Desault recommended; or by introducing a wire, red-hot, or heated by galvanism, as Mr. Marshall has suggested. The external fistulous opening must then be pared and closed with a twisted suture.

DISEASES.—*Tumours*.—Various species of morbid growths form, occasionally, on, or in the cheek; fatty and fibrous tumours, as I have seen in two cases; cartilaginous, cystic, and cancerous; or vascular and erectile tumours.

The removal of any such tumour can generally be accomplished by careful excision, having regard to the thickness of the cheek and the relation of the growth to surrounding parts; or, the subcutaneous application of ligature will probably be available, in the case of an erectile tumour. It is sometimes remarkable how much the cicatrix, after such operation, becomes effaced in the course of years.

*Corroding Ulcers* of the Cheek, may occur in two forms. *Lupoid* ulcer has all the characters of this form of Ulcer; the hollow excavation, absence of granulations, thin, worm-eaten and everted margin—thus contrasting with a cancerous ulcer. The ravages of lupoid ulceration are equally notable. The features disappear as the ulcer extends; the nose and mouth may fall into one cavity and the eye drop down from the orbit, exposing the back of the pharynx, nares, antrum and interior of the orbit, in one large, irregular and carious-bottomed excavation; which completely disguises any recognition of the individual face, or even obliterates its form as that of the human face. Such a result had occurred in a poor person, who, if I remember rightly, was found on a door-step one night, many years since; and a wax-model of whose

horribly remnant face is deposited in the Museum of the University College, London.

The *treatment* of this form of Ulcer is noticed under Lupus. Chloride of zinc in paste, well applied to the excavation, is far more effectually curative than excision. This I once saw in a case treated by Mr. Liston, and similar results were obtained by Mr. Moore, in two cases. In one of these, the surface was known to have remained perfectly healthy two years and a half afterwards; although the disease had destroyed the greater part of the contents of the right orbit, the eyelids and skin in the neighbourhood.

*Cancrum oris*.—Another form of corroding ulcer, a phagedæno-gangrenous ulceration affecting the inner surface of the cheek and lip. Commencing, usually, with a brawny, tense, shining swelling of the cheek; the corresponding interior of the cheek soon presents a deeply excavated, round ulcer, having a brown, pulpy, sloughy surface. Differing somewhat from this typical condition of the disease; it may commence, in its most rapid form, as a black gangrenous spot, unaccompanied by any surrounding inflammatory swelling; or, in a milder form than usual, it presents a shallow, ash-coloured ulcer, situated on the inside of the lip, more often the lower one, and extending to the cheek. This latter form of the ulceration seems to have a diphtheritic character.

The disease may extend considerably; the excavated ulcer inside the cheek perforating and opening in the form of a circular dark-coloured gangrenous cavity, communicating with the mouth. The gums are turgid and spongy; while a fœtid saliva and putrescent discharge dribbles from the lips. Comparatively little pain attends the process of destruction; but the constitutional exhaustion is often fatal, and the patient sinks in a comatose state.

The *cause* of cancrum oris is general debility; resulting from poor living, among the ill-fed and otherwise destitute children of large towns, who are chiefly affected. Or, the disease may be a consequence of one of the eruptive fevers, as measles or scarlatina, or any other severely reducing illness; and occasionally, it has followed the prolonged administration of mercury. The feeble, wan, abject aspect of the poor little victim, will be readily associated with the characteristic appearance of the buccal or labial ulceration.

*Treatment*.—Local applications must be employed to arrest the disease, and correct the fœtid, self-poisoning discharge. Hence, the nitrate of silver should be freely applied, or the strong nitric acid will probably be necessary; and the mouth should be syringed with chlorinated solutions. But the constitutional treatment is most curative; and, quinine and ammonia, the latter not pushed to its depressing effect, with wine, beef-tea, and other nutritious food, are the most efficient measures. Chlorate of potash in large doses, is said to have an almost specially remedial influence. My own experience does not enable me to confirm this view.

The deformity resulting from cicatrization, may require some plastic operation for its rectification.

*TONGUE*.—*Wounds*.—Severe hæmorrhage, principally from the lingual artery, is the chief point of practical importance, in wounds of the tongue. The lesion itself is apt to occur by an accidental bite of the tongue, and not unfrequently severe laceration is thus occasioned during an epileptic fit. When the organ is protruded, a blow on the lower jaw has been known to nearly sever the tongue; as happened in the case of a patient of mine, to which I have particularly alluded in illustration of the general law of

primary adhesion, and a similar extent of lesion has occurred from a blow in a prize-fight.

*Treatment* must first be directed to the arrest of hæmorrhage, which may be effected by ligature or torsion of the lingual artery; any oozing of blood being then restrained by means of ice-water held in the mouth and repeatedly renewed. The divided parts may be adjusted with sutures; which, however, speedily separate, and union will probably as speedily take place. It is a remarkable fact, how much the sense of taste is gradually restored; showing that the gustatory nerve, when divided, reunites without apparently any interruption in the continuity of its nerve tissue.

*Foreign Bodies* are sometimes thrust into the substance of the tongue, and may even become embedded and concealed. In the Museum of Guy's Hospital, there is a specimen (1674) showing a piece of tobacco-pipe, over which the substance of the tongue had closed. Frequent hæmorrhage occurred, and ultimately proved fatal.

In any case, the foreign body should of course be removed, if possible.

*Tongue-tie* signifies a congenital shortening of the frænum linguæ, whereby the apex of the tongue is depressed and restrained; so that it cannot be protruded beyond the incisor teeth, and there is difficulty in suckling, and eventually indistinct articulation in the adult.

This defect can easily be remedied, by snipping the bridle across with blunt-pointed scissors; observing to direct their points downwards just to avoid the ranine arteries. Not unfrequently, mothers request such relief very unnecessarily.

*Prolapsus* of the tongue may undoubtedly occur; it having been noticed by Zacchias in 1628, Bertholin, Sauvages, Percy, Laurent, Mirault, Maurant, Lassus, Crosse, and Professor Humphry. In a case recorded by the latter author, the organ was enormously enlarged, both in circumference and length; the portion immediately within the lips having five inches circular measurement, and when the tongue was drawn into the mouth as far as possible, the length from the upper lip to its tip, measured two inches. The protruded organ had been habitually suspended in a bag from the head. It was soft and supple, but of a granular or warty appearance, with deep clefts, owing to hypertrophy and separation of the papillæ; the colour remaining natural. The opening of the mouth was enlarged, the lower lip everted, and the angles of the mouth depressed; elongating and giving a peculiar expression to the face. The orifices of the sublingual ducts, also enlarged, were situated just in front of the edge of the lip; and thence the saliva dribbled continually from the end of the tongue, to the amount of more than half a pint daily. The mental portion of the jaw and inferior incisor teeth, had become everted by constant pressure of the tongue, forming a curvature in which the organ lay; and a wide interval also between the teeth, which, even when the mouth was closed and the molars were in contact, was nearly two inches in extent between the upper and lower incisors.

This condition of the tongue may be congenital, or acquired as a consequence of profuse salivation. It is attributable to hypertrophy, or possibly to a paralytic state of the retractor muscles of the tongue.

The *treatment* of prolapsus linguæ is unsatisfactory. The protruding portion may be removed by excision, a perilous and even fatal adventure; or by ligature, with the formation of a poisonous slough, for a while, in front of the mouth and nostrils; or by means of the écraseur—a mode of



excision and rapid strangulation, thus avoiding the risk of hæmorrhage and slough. Pressure has caused the swelling to partly subside, but it has returned again.

**DISEASES.**—*Glossitis*.—Acute inflammation of the tongue is attended with sudden enlargement of the organ, which protrudes from the mouth, presenting a red mammillated appearance, with profuse salivation; while the patient can neither speak nor swallow, or scarcely breathe. It occurs rarely as an idiopathic affection, sometimes as a consequence of over-salivation from the abuse of mercury. *Treatment* is urgent, and the tension resulting from infiltration of serum and from congestion can be at once relieved by a free incision on either side of the raphe, along the dorsal aspect of the tongue, thereby avoiding the ranine arteries. But it should be remembered that the œdema may so far involve only one side of the tongue as to cause the lower surface, which swells more readily, to be turned directly upwards; the incision made above passing into the tissues naturally inferior, and which would resume this position as the swelling subsides. Tracheotomy may have to be resorted to for the relief of dyspnœa. Saline purgatives will however usually complete the reduction of the swelling, when they can be swallowed, after the immediate relief afforded by incisions. Astringent and cleansing gargles are also useful adjuncts.

*Abscess* of the tongue—should it occur—may be detected on careful examination of the deep-seated semi-elastic, and fluctuating swelling. It must be punctured as soon as possible.

*Ulceration* is liable to occur, in a simple form, as the result of irritation by decayed teeth; or in a specific form, as a manifestation of secondary syphilis. Fissures and milk-white stains on the dorsum of the tongue, coupled with the history of syphilis; will determine the diagnosis. The *treatment* varies of course with the cause; the removal of a decayed tooth, and aperient stomachic medicines, may prove sufficient to heal the ulcer; or, it must be treated as a secondary form of syphilis, by the topical application of nitrate of silver with the administration of iodide of potassium and bark.

*Syphilitic tubercle*, and *Psoriasis* of the tongue, mostly having syphilitic origin; must be treated in like manner.

**Tumours** (1) *Cancer* of the tongue may occur in, perhaps, three forms. *Scirrhus*, commences as a firm, incompressible knob on the edge of the tongue, and situate often opposite the last molar or wisdom tooth. Considerable pain and difficulty are experienced in moving the organ and in deglutition, and pain darts along the Eustachian tube towards the ear. The saliva flowing from the mouth, and fœtid secretion accumulating in the throat and exciting cough, combine with the pain, sleeplessness, and want of nourishment, to reduce the patient. At length, a deep excavated ulcer forms, and hæmorrhages occasionally supervene. The submaxillary glands become affected; presenting first, a circumscribed and then a diffused tumour in the neck, covered by reddened and thinned integument; this also ulcerates and discharges a thin fœtid fluid, with occasional hæmorrhage. Emaciation and cachexia supervene according to the duration of the disease. Death took place in ten months, from arterial hæmorrhage, in the case of the late Bransby Cooper. A deep excavation was found at the root of the tongue and the tissues around, extending to the muscles about the hyoid bone, and the adjoining lymphatic glands were infiltrated with cancer.

*Soft cancer*, in the form of an irregular lobulated mass, of reddish-brown colour with vascular red points, and of a spongy succulent character, was the kind of malignant disease in a case recorded by Mr. Ceely of Aylesbury. The tumour protruded from the mouth, and a large portion weighing seventeen drachms and a half, was easily peeled off, exposing a large jagged surface covered with coagula. But the hæmorrhage was moderate, and soon repressed with matico powder. The growth returned within a week, yet the man was still alive thirteen years after the operation.

*Epithelial cancer* forms not uncommonly on the tongue, as on the lower lip. It presents an opaque white raised patch, consisting of matted epithelial scales, which becoming detached at length exhibits an ulcer of irregular surface, with hard everted edges produced by epithelial infiltration around the ulcer. Co existing with such a patch or ulcer on the dorsum of the tongue, I have seen two more buttons on the hard and soft palate. Considerable pain may be experienced, but the functional inconvenience will depend on the situation and extent of the part affected. The sub-maxillary glands sometimes remain unaffected. The disease progresses slowly, in one case existing twelve years, in another sixteen years. The particulars of both these cases are given in Holmes's Surgery, by Mr. Holmes Coote, who regards the disease as not of a cancerous nature.

*Treatment*.—Any cancerous disease of the tongue must be extirpated by surgical operation; no known medicinal treatment having any curative effect. The extirpation must be carried freely around the cancerous infiltration, to lessen the probability of the disease recurring. This may be accomplished by excision with the knife, or by ligature.

*Excision* may be either partial, or complete removal of the whole tongue. The former procedure is appropriate and practicable when the disease is limited to the tip or anterior portion of the organ; the latter operation, becomes absolutely imperative, as the only chance of safety, when the disease is more extensive.

*Partial excision* is easily performed. The patient being seated in a chair with the head supported, and, more conveniently, not under the influence of chloroform; an assistant draws the tip of the tongue forward and retracts the cheek. The Surgeon then seizing the whole tumour within the blades of double-hooked forceps, passes a blunt-pointed bistoury around it, and by almost one sweep of the knife removes the mass. If the operation be incompletely performed at once, the hæmorrhage will preclude a satisfactory examination of the remaining portion of the tongue. If the lingual artery be wounded, this vessel must be commanded by a ligature or torsion; any further hæmorrhage can generally be restrained by ice. The cut surface soon heals, leaving a puckered cicatrix, which is distinguishable from reproduction of the disease by the absence of induration.

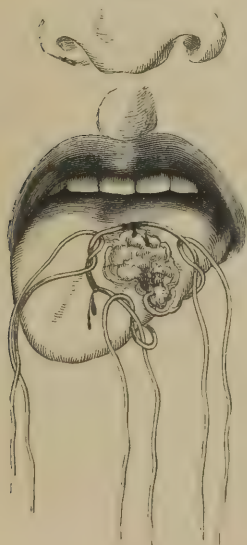
*Complete excision* of the tongue. Large portions of the tongue have been successfully extirpated by Regnoli's operation;—simply an incision into the floor of the mouth, extending, under the jaw from one angle of the bone to the other; a vertical incision in the middle of this, from the hyoid bone forwards, will enable the tongue to be more readily drawn downwards through the opening, and nearly the whole organ can then be removed.

Syme's operation, for complete extirpation, consists, in making an incision through the middle of the lower lip and carrying it over the chin

down to the hyoid bone; the symphysis of the jaw is sawn through, and the mylo-hyoid, genio-hyoid and genio-hyoglossi muscles separated; the two halves of the bone are drawn asunder, and the larynx is drawn forwards, thus exposing the whole tongue down to its very root,—the hyoid attachments. The organ is then to be completely excised. Mr. Fiddes of Jamaica, subsequently performed this operation, and recommends that the lingual artery should be ligatured and divided on either side, separately; in order to reduce the amount of hæmorrhage.

*Ligature.*—Portions of the tongue have been removed by ligature, in preference to excision. The risk of hæmorrhage is thus diminished or avoided; but the operation is more painful, tedious, and prejudicial in consequence of contamination during the course of sloughing. To obviate the first objection, and check the profuse secretion of saliva, Mr. Hilton has proposed and practised section of the lingual nerve, prior to the application of ligature. No sensation from the tumour can then be conveyed along the nerve; no reflected irritation can reach the collateral branches of the fifth nerve; no stimulus to an increased secretion of saliva can be given to the salivary glands. Eminently, therefore, an operation based on a physiological principle; the patient should speak more freely, and swallow with less difficulty, should be relieved of pain in the tongue and jaw, temple and crown of the head, and of the incessant inconvenience arising from the dribbling of saliva; he should sleep better, and become better nourished than before. Mr. Hilton sought for the nerve in the floor of the mouth, and exposed it by an incision along the mucous membrane close to the sub-lingual gland. Mr. Moore, who has more recently divided the nerve, takes the last molar tooth as his guide, where the nerve coming forward from under the internal pterygoid muscle is covered only by the mucous membrane. Passing a curved bistoury into the mouth and behind the last molar tooth, an incision three-quarters of an

FIG. 348.



inch long down the jaw, and across the course of the nerve, must divide it. Ligature of the corresponding lingual artery has been combined with this operation by Mr. Moore, in order to cut off the supply of blood to the affected part.

Ligature of the affected part may be performed as for nævus; care being taken to plant the operation sufficiently wide of the disease, and to strangle the mass effectually and completely. (Fig. 348.)

A diseased part of the tongue, situated far back in the organ, has been reached by a vertical incision under the jaw, between the genio-hyoid muscles; and thus Cloquet and Arnott have succeeded in passing ligatures, by means of long needles, through the tongue, and strangling the mass.

The *écraseur* has been recommended by M. Chassaignac for the removal of portions of the tongue; but, while thus reducing at least the risk of hæmorrhage, and avoiding the contaminating influence of sloughing, this mode of combined excision and strangulation



has not found much favour in this country. The instrument is introduced through the tongue, which is drawn out of the mouth, or by an incision under the jaw for the passage of the *écraseur*. It should be worked slowly; two minutes being allowed to elapse between each movement, the transverse division of the organ was effected in half an hour. A second chain is required to free the severed tongue from its muscular attachments; the double operation extending to an hour for its completion.

(2) *Erectile Tumour* or *Nævus* of the tongue is an uncommon form of growth, and does not attain to a great size. Removal can be effected by excision, or, preferably, by ligature; and it may be necessary to reach the affected portion of the tongue through an incision in the mylo-hyoid region.

(3) *Fatty tumour* has been known to occur, either in the substance of the tongue or underneath the organ. In the Museum of the Royal College of Surgeons there is a specimen, No. 190, of fatty tumour taken from the one situation; and Mr. Paget removed another, oval and bilobed, tumour, also from the substance of the tongue, near the apex, where it had been growing for three years. In the Museum of the Middlesex Hospital, there is a fatty tumour, one and a half inches long, which was removed from beneath the tongue, where it looked like a ranula; and a lobulated tumour was removed from the same situation by Mr. Liston.

(4) *Ranula* is a semi-transparent, bluish-white, fluctuating, cyst-like, swelling; situated under the tongue, to one side of the frænum, corresponding to the position of the sub-maxillary gland. The swelling is attributed to a dilatation of the duct—Whartonian duct, of this gland, which forms a sacculated enlargement. This origin is doubted by Mr. Erichsen; but in one case, under the care of Mr. Lawrence, the little finger could be inserted for a short distance into a cylindrical tube, pursuing the normal course towards the gland; and in another instance Mr. Holmes Coote removed a phosphatic concretion, about the size of a pea, from Wharton's duct, thus indicating the mode of origin of ordinary ranula. It disappeared in a few days.

*Cysts* may form, in the same situation, from, perhaps, four sources—(1) dilatation of Wharton's duct; (2) dilatation of one of the sub-lingual ducts; (3) enlargement of a mucous follicle; (4) enlargement of a bursa mucosa, said to exist on the outer surface of the genio-hyoglossus muscle.

The same symptoms arise from any such swelling; the tongue is pushed upwards and backwards, interfering proportionately with speech and deglutition, as ordinary ranula attains the size of a walnut or pigeon's egg. An enlarged bursa presents an elastic swelling more under the side of the jaw, and which attains to a larger size, that of an orange or larger. The contents of these cystic swellings differ; a dilated Whartonian duct or an ordinary ranula contains a clear, glairy, fluid, like white of egg, with, occasionally, perhaps, phosphatic concretion; an enlarged mucous follicle is filled with a putty-like matter consisting of epithelial scales with granular fat; while an enlarged bursa contains a clear, serous, fluid, occasionally tinged with blood.

*Treatment.*—Ordinary ranula may be made to disappear by introducing two or three threads of seton through the front of the sac, the ends are loosely tied, cut off, and the seton left in the mouth. Or, the sac may be snipped with scissors, making a button-like aperture, and the interior touched freely with nitrate of silver.

Mucous cysts are generally loosely attached, and can be dissected out

entire. Enlarged *bursa*, presenting in the neck, can be evacuated by a trochar, and injected with dilute tincture of iodine. Or the seton may be here employed; and Mr. Skey passes it through the floor of the mouth to the most dependent part of the cyst.

GUMS and TEETH.—DISEASES.—*Alveolar Abscess*—*Gumboil*, or *parulis*, as it is technically named, is the simplest and commonest form of this abscess; occurring as an abscess of the gum around a tooth, usually carious. Alveolar Abscess may be described—according to Mr. Salter's definition—as a suppuration around the fang or fangs of a tooth, which is usually carious, accompanied by absorption and expansion of the bony walls of the alveolus or alveoli, and the enlargement of the little pus-sac; the matter gradually finding its way to the surface, either along a canal by the side of the fang of the tooth and opening at the edge of the gum, or through the gum itself at a point corresponding to the end of the root or roots of the tooth implicated. When, however, the fangs are unusually long, or the reflection of the mucous membrane from the gum to the cheek or lip is very superficial, the matter may burrow still more outwardly, and find its exit upon the surface of the face.

An alveolar abscess about to burst externally, presents certain characteristic appearances—the integument becomes firmly glued down to the bone around the spot where the matter ultimately points; the area within this space is red, distended and glistening; the skin becomes thin and papery, and the cuticle scales off. If the surface be kept dry, the abscess often remains stationary for some time; at length; it bursts through a jagged opening, which soon changes into a small, fistulous, orifice, encircled by a pouting lip of granulations. The lip of granulations may be elongated into a papilla, even more than half an inch in length; and closing for a time, it bursts again, as matter reaccumulates. This papilla will return repeatedly after excision by the knife, until the cause in operation—the carious tooth, is itself removed. The *situation of the opening* is diagnostic of the source of abscess—the particular tooth affected. In the upper jaw, alveolar abscess appears upon the cheek at a point corresponding to the extremity of the tooth's fang, under the edge of the malar bone; in the lower jaw, it forms along the edge of the jaw below the buccinator muscle when the molars or bicuspid are its source; and when proceeding from the inferior incisors (canines also?), it points generally beneath the chin, a large pad of granulations forming, the size of a thumbnail, from the centre of which the discharge issues. Abscess associated with the upper incisors or canines never, perhaps, points upon the surface of the cheek; while that of the bicuspid, first and second molar, and all the teeth of the lower jaw, may produce this form of the disease. In children with the milk-teeth, alveolar abscess seldom, if ever, opens externally.

The *diagnosis* of alveolar abscess, as above determined, is important; not to mistake it for diseased bone, nor to attribute an abscess to carious teeth, which may be coincident, but not the cause.

*Treatment*.—Warm fomentations afford relief and bring the abscess forward; an incision through the gum or cheek will then evacuate its contents; but extraction of the diseased or dead tooth is the only certain cure. Two conditions only forbid this curative treatment; an hæmorrhagic diathesis, leading to protracted bleeding after the extraction of a tooth; and abscess associated with the upper incisor teeth in young persons, where the jaw has not yet assumed the adult form, and permanent denti-

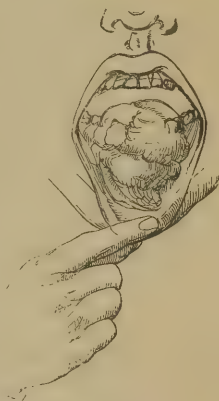
tion is incomplete. Extraction of the incisors would then be followed by such contraction of the maxillary arch, as might render it impossible to replace the natural teeth by corresponding artificial teeth.

*Ulceration.*—The gums may present one or more ulcers as the result of alveolar abscess, or they are liable to undergo ulceration in consequence of various constitutional conditions—syphilis, excessive mercurial salivation, and the eruptive fevers.

Treatment consists in tonics, principally bark and the mineral acids, the regulation of the digestive organs, and the local application of nitrate of silver; with chlorinated and astringent gargles.

*TUMOURS.*—(1) *Epulis.*—This is a simply fibrous, or a myeloid and recurring form of growth, springing apparently from the gum, but actually more deeply, from the periosteum of the alveolus, externally, or internally within the tooth-socket. The adjoining bone is very vascular. Presenting, usually, at the edge of the alveolus, between two standing teeth, and more commonly on the labial or buccal aspect than towards the tongue; the tumour grows slowly, displacing and loosening the teeth, and somewhat expanding the alveolar border. It is broad-based (Fig. 349), slightly lobulated, firm, and elastic, smooth, red, painless, and little inclined to bleed, resembling the adjoining gum. It attains to a limited size, varying from a pea to a walnut or larger, or possibly to a remarkable size, with protrusion, and presenting an everted appearance. The upper jaw is more frequently the seat of epulis than the lower jaw, in, perhaps, the proportion of two to one.

FIG. 349.



The *diagnosis* of this kind of growth is simple; hypertrophied gum, in the form of loose flaps and masses, known as polypus and fungus of the gum, and occurring in connexion with decayed teeth; exhibits the only appearance with which the growth can possibly be confounded. The relation of epulis to the presence of teeth, as a cause, may be thus stated. Generally, making its appearance where there are teeth, the growth usually invades one, far more than the adjoining teeth; although caries of that tooth has no apparent causative influence, and occasionally the tumour appears in an edentulous portion of gum.

Ulceration of the surface of the tumour and discharge may ensue, but these or other changes seem to result from external agencies.

*Treatment.*—Early and complete extirpation with the knife, is the only permanent cure. This is accomplished by extracting the tooth or teeth, excising the tumour clean down to the bone, and then removing with cutting-pliers or small saw, the portion of alveolar process corresponding to the base of the growth, and whence it sprang. After having thus performed the operation, I have never yet seen epulis return. In a recent case, where the epulis had been simply *shaved* off, the growth had returned, although originally a small one, involving only the left middle incisor tooth; but upon removing this tooth and a portion of the alveolus by a V-shaped incision, including the tumour, it had not returned some months after the operation.

(2) *Congenital hypertrophy* of the gum and alveolar borders of the



maxillæ—has been met with, by Mr. Pollock at St. George's Hospital, in 1859, and a similar case was first described and figured by Professor Gross, in the Second Edition of his *System of Surgery*. The tumour-like growth was identical in both cases. A large mass, pink and smooth, protruded from the mouth; it was very hard, inelastic, slightly lobed, and insensitive. It consisted of an expanded and prolonged development of the alveolar borders and an immense thickening of the fibrous tissue of the gum, with a proportionately exuberant growth of the papillary surface, covered by a very thick and hard epidermis. The papillæ were enormously lengthened, so that when the epiderm was removed, they stood up like the pile of plush or velvet, and could be brushed from side to side with the finger; this papillary hypertrophy being distinctive of the tumour-like outgrowth. The gums of both jaws were affected, more so the upper jaw, and most enlarged in the front of the mouth where it overlapped the edge of the lower jaw. The coincident early cutting of the teeth, one tooth having appeared a fortnight after birth and six by the fifth week, together with a large quantity of hair on the head and body; would seem to indicate a tendency to a general tegumentary hypertrophy. At birth however, the mouth was natural, but in five or six weeks, the gums had become full and thick.

The *treatment* adopted, was partial and repeated removal of the projecting mass, until the alveolar borders were reduced to within moderate limits. A slight tendency was evinced to return of the hypertrophy.

(3) *Polypus*.—The gum is liable to a simple hypertrophy, as an outgrowth, in the form of mucous tubercle; affecting the gum-structure alone, and not involving the osteal membrane, nor complicated with a growth of the alveolar border of the jaw. The seat of this affection is mostly, the little tongues of gum between the teeth, particularly towards the front of the mouth; these portions of gum growing up, perhaps, so as to partly cover the crowns of the teeth. An uncleanly state of the teeth, allowing the accumulation of tartar, is usually associated as the cause of this hypertrophy; or it may be a syphilitic condition.

*Treatment* consists in simply cleansing the teeth with a tooth-brush, using an astringent tooth-powder, and a similar lotion of tannin or permanganate of potass. Tartar must be removed by properly scaling or scraping the teeth. A carious tooth should be extracted, filed down, or plugged. The polypoid gum-structure may have to be extirpated. A syphilitic taint will require the appropriate constitutional treatment of this disease.

(4) *Vascular Tumours*.—Nævus and aneurism by anastomosis occur, sometimes, about the necks of the teeth; more commonly in front of the upper jaw, between the incisors, or canines and lateral incisors. Springing, apparently, from spongy vascular bone; the tumour attains a variable size, about that of a marble, with a somewhat constricted base; it has a purplish colour, is elastic and compressible, becoming reduced in size and pale on pressure, it regains its previous characters in a pulse or two; and there is a constant throbbing sensation without pain. Oozing hæmorrhage proves troublesome from time to time, and even dangerous during sleep, the blood trickling into the glottis. The whole of the gums are turgid and red. These tumours have been observed more frequently in adult and middle life; they are perfectly innocent, and evince no tendency to return, when eradicated.

The *treatment* must be removal by ligature or excision; preferably in the latter way, including the bony base of the tumour. Hæmorrhage can be restrained by cold and pressure, and if profuse for a minute or two, it soon ceases.

**TEETH.**—**INJURIES and MISPLACEMENTS.**—*Fracture and Dislocation.*—A portion of a tooth may be broken off, without exposing the pulp cavity; the fractured surface should be filed down smoothly. With exposure of the pulp cavity, as when a tooth is broken off at its neck; pain and inflammation may be subdued by anodyne applications or by destroying the nerve. It may become necessary to extract the tooth. A loosened tooth should be braced to a neighbouring firm tooth with silver wire. A tooth, knocked out of its socket, has been replaced, and has permanently retained its hold.

*Eruption of Milk-teeth.*—Swelling and tenderness of the gums always attend the natural process of teething; eruption of the teeth may, however, be readily facilitated and the accompanying symptoms relieved, by means of the old-fashioned coral, a piece of india-rubber or other elastic material, which the child will naturally bite and thus cause the gum to yield before the rising tooth. But, not unfrequently, the dental source of irritation seriously disturbs the general health, and even provokes convulsions. Lancing the gums, relieves both their inflammation and resistance to teething.

*Mal-Eruption of the wisdom-teeth.*—The restricted space afforded to the wisdom-teeth, owing to their position at the back of either jaw, the shape also of the lower jaw curving upwards and the reflection of the gum upwards to the cheek and fauces; are anatomical conditions liable to prevent the easy eruption of these teeth, and pervert the direction of their growth. Hence, difficult cutting and misplacement, particularly in the lower jaw. The upper wisdom-teeth are misplaced backwards or outwards, commonly in the latter direction; the lower teeth point horizontally forwards, sometimes with an inward inclination, and very rarely the direction is outwards. Pain is experienced, especially in moving the jaws and bringing them together; inflammation and swelling succeed, extending to the cheek and fauces so as to render deglutition difficult and simulate ordinary sore-throat. Abscess and ulceration of the gum frequently follow, matter sometimes bursting through the cheek; and painful cutting of a lower wisdom-tooth often occasions a tonic spasmodic contraction of the masseter muscle, thereby closing and fixing the jaws.

The rectification of these tooth-cutting difficulties, pertains rather to mechanical dentistry; but it is necessary that the general Surgeon should be able to recognise the nature of any such case which may come under his notice in the course of his practice.

*Irregularities of the Permanent Teeth.*—These conditions should also be referred to the special experience of the Dental Surgeon.

**DISEASES.**—*Caries and Necrosis.*—The former term is synonymous with the decay of a tooth; a process of disintegration proceeding from some point on the external surface of the tooth, and spreading through the enamel, or the crusta petrosa below the gum, and the ivory; until it penetrates and exposes the interior of the pulp cavity. The opening may be large, involving a large extent of the tooth; or small, as a pin-hole aperture. Discoloration, with the destruction of tooth-substance, will be more or less visible; but exposure of the pulp-cavity always induces fits of *toothache*.

Dental caries may result from some originally imperfect formation of the tooth-structure; more often, it is a consequence of scrofula, syphilis, or the abuse of mercury. Any hereditary taint of the first-named constitutional diseases, will probably cause early caries of the teeth. Certain medicines, as the preparations of iron, and mineral acids, are said to have a carious effect on the teeth, by contact in the act of swallowing them. Pregnancy also seems to have some influence; though it is difficult to explain in what way the teeth become affected.

*Treatment.*—The Surgeon will be called upon to reduce the inflammation and relieve the toothache, consequent on dental caries. The ordinary antiphlogistic measures—fomentations, leeches, aperients, &c., are of little avail, if any, unless the exposed nerve can be deadened, and the pulp-cavity closed. The tooth should be stopped with a small plug of cotton wool, soaked in mastic with chloroform, opium, or other anodyne. Sometimes, stimulant or astringent applications answer better—*e.g.*, creosote, and other essential oils, a bit of pellitory chewed, or a strong solution of nitrate of silver; a solution of tannin or alum. Acidity of the saliva can be neutralized by washing the mouth out with a solution of carbonate of soda or other alkali. Exposure to cold, and of the teeth to hot or cold liquids, sweet, acid, or stimulating food, must of course be avoided; and during an attack of toothache, the pain will mostly impose sufficient personal restraint. Afterwards—when pain and inflammation have subsided—permanent stopping of the tooth, or extraction, should be left to the judgment and skill of the dentist. Any constitutional treatment necessary in regard to scrofula or syphilis, must be conducted on ordinary principles.

*Polypus of the tooth-pulp.*—A dense, gristly, pink-coloured growth of the tooth-pulp, occurs sometimes in a carious tooth; occupying the carious cavity, or presenting a more exuberant growth, it then resembles epulis or a gum polypus. The remains of the decayed tooth will determine the diagnosis. This polypoid growth is very callous and insensitive to pain, and thus differs from the *sensitive growth* of the pulp after fracture of a tooth.

Extraction of the tooth is the only certain and permanent remedy, in either case.

A turgid state of the gum connected with a decayed tooth, gives rise to a wearing pain or *gum-ache*, which becomes excruciating on the accidental contact of a bit of crust of bread or other hard portion of food.

Relief is obtained by freely scarifying or deeply incising the swollen gum; and when the engorged vessels are well unloaded, gargling with a solution of tannin, or other astringent.

*Inflammation of the pulp-cavity*, without caries.—This circumscribed inflammation occasions intense pain which extends deeply beyond the tooth into the jaw, and accompanied with some tenderness of the surrounding gum. Suppuration within the cavity evokes greater agony, the matter being pent up; alveolar abscess probably follows, and partial absorption of the fang or fangs. The tooth is destroyed, even more entirely than by caries; and the partial removal of the tooth would seem to be Nature's mode of ejecting it, as a foreign body.

*Treatment* consists in local and general antiphlogistic measures, and extraction of the offending tooth.

*Neuralgic toothache* should not be mistaken for toothache of an inflammatory character, whether consequent on caries or occasioned by inflam-



mation, affecting the pulp-cavity. The tooth may be apparently sound as it is in the last described form of inflammation; but the pain, grinding, boring, darting, is even more distracting, and it is distinctly paroxysmal—coming and going almost suddenly, at intervals. Similar pains may also occur in other parts, usually subject to neuralgic affections, as supra-orbital-neuralgia; and the cessation of one such affection will perhaps be succeeded by toothache; thus more clearly indicating its neuralgic character.

Malaria, and the rheumatic diathesis, are predisposing causes; and pregnancy seems especially to provoke these attacks, during the earlier months of this state.

The *treatment* relates solely to medicinal measures. Quinine in large doses commonly affords relief; especially when taken shortly *before* an attack, which may thus be averted. Careful regulation of the digestive organs, by antacids, rhubarb and blue pill, will often prove curative where the anti-periodic tonic treatment would fail. A rheumatic tendency must be overcome by medicines suitable to this constitutional condition.

Extraction of the tooth, if structurally sound, would of course be an unscientific proceeding to relieve an affection, however painful, which arises from any constitutional cause. The removal of a tooth temporarily affected, not unfrequently simply transfers the neuralgic pain to another tooth; and in pregnancy especially, it should be the last resource for the relief of a passing symptom.

*Hæmorrhage after Tooth Extraction.*—Protracted and obstinate bleeding sometimes occurs after the extraction of a tooth; the blood continuing to well-up in the socket, until in the course of many hours or days of such hæmorrhage, the patient may be reduced to a state of bloodless exhaustion.

The *treatment* is primarily topical. The socket must be carefully plugged with a strip of lint, the end of which is introduced and driven well home to the bottom, and the strip folded and compressed in successive portions, so as to fully occupy the socket up to the level of the gum or to meet the opposite tooth; the jaws are then to be firmly closed and secured by a broad vertical bandage, passing under the chin and over the top of the head. Astringents have been used with advantage, in conjunction with this plug; it may be dipped in turpentine, or an alcoholic saturated solution of tannin, or loaded with powdered matco leaf. No form of simple plug fits so exactly to the socket as the tooth itself, when it can be obtained. The hæmorrhagic tendency will be advantageously combated by the administration of internal astringents; of which tannin and turpentine have been employed most successfully, and the latter combined with iron, especially the muriated tincture. An elevated posture and derivative warmth to the lower extremities, have some co-operative efficacy. Opiates may become necessary to allay the irritability of sanguineous exhaustion. In women the hæmorrhage may be vicarious to suppressed menstruation; when remedies should be directed to the restoration of this function.

*Tooth-stopping and Extraction.*—These procedures, the adaptation of mouth-pieces, and the construction and fitting of Artificial Teeth, obviously pertain to Mechanical Dentistry.

## CHAPTER XLIV.

## DISEASES OF THE JAWS.

INJURIES.—See Fractures and Dislocations.

FISSURE OF THE PALATE OR CLEFT PALATE.—This congenital malformation consists of a mesial fissure of the uvula alone, or of it and the

FIG. 350.



soft palate; extending sometimes along the hard palate; and occasionally forwards to the upper lip, thus presenting the concomitant condition of single or double hare-lip. Rarely, the lip and the hard palate are fissured, without involving the soft palate. On opening the mouth, this fissured condition is at once seen (Fig. 350), and its obvious interference with speech and deglutition are readily elicited; the patient speaking with a snuffling nasal tone of voice, and in the act of swallowing fluids, some of the fluid regurgitates and may escape through the nose.

*Age for Operation*, to reunite the palate.—Cleft palate when extensive may affect the safety of the infant's life, by preventing a due supply of nourishment; on the other hand, it is ab-

solutely necessary that the patient should have the discretion and the will requisite to remain steady during an operative proceeding of nice manipulation and protracted character, and which afterwards requires an abstinence from speech and restricted deglutition for some days, not to disturb the process of adhesive union. Duly weighing these two considerations, it may be taken as a rule that the child should have reached the age of about fifteen years, before the operation is attempted. Fergusson and Sédillot have, however, performed it on young children with entirely successful results; and in one case, Billroth succeeded before the age of twelve months, in closing a cleft which extended from the lip to the uvula. The state of the general health should of course be considered, with regard to the probability of union after operation.

*Staphyloraphy*—as the operation is often termed—was introduced by Roux; previous to which an artificial palate or obturator had been used. Roux's operation consisted simply in paring the edges of the fissure and bringing them together for union by interrupted sutures, in the manner of hare-lip. It was practised, with modifications by Graef, Warren, Dieffenbach, Liston, and other Surgeons.

Sir W. Fergusson's operation is an essential and most important modification of this proceeding. It consists in first dividing the muscles (Fig. 351), principally the levatores-palati and palato-pharyngei, which as causing traction and motion of the palate, are antagonistic to union; thus introducing the physiological principle of *myotomy* into the operation. Prior to this innovation the flaps of the palate had been brought into

easy apposition, on the mechanical principle of enlarging the palate, chiefly by a longitudinal incision on either side; and Mason Warren also had divided the anterior pillar of the fauces and its attachments to the posterior pillar—an approach to Fergusson's Operation in its performance, but having a purely mechanical design.

Sir W. Fergusson's operation is as follows:—Previous to paring the edges of the cleft, a knife—which he devised, in the form of a spear-head, and curved on a slender stem—(Fig. 352) is introduced into the mouth and passed through the fissure, so that its point shall be laid on the tissues immediately above the velum, midway between its attachment to the bones and the posterior margin, and about half way between the velum and the lower end of the Eustachian tube; the point is then thrust deep, and carried half an inch or more backwards and forwards so as to cut the levator palati across: next the uvula is seized with a pair of long hook-beaked forceps and drawn forwards, thereby putting the posterior pillar of the fauces on the stretch, which is then snipped across with long, curved, blunt-pointed scissors, about half an inch behind the tonsil, dividing the principal part of the palato-pharyngeus; then if it seems desirable, the anterior pillar of the fauces is touched with the scissors, dividing the palato-glossus—a proceeding scarcely requisite. The flaps of the soft palate thus having been relieved from muscular action, they approximate and hang loosely. The remainder of the operation consists in paring the edges of the fissure, and the introduction of sutures to retain them in easy and even contact. The Surgeon seizes the point of the uvula on one side of the fissure with the forceps, drawing it slightly forwards, and then carries a narrow probe-pointed bistoury from the posterior border of the velum to the anterior part of the fissure in the soft palate, so as to make a clean cut raw surface of its margin; the other margin is then pared in like manner. Or, if apparently more convenient, the edges can be pared by seizing the margin about the *middle* of the fissure and holding it firmly, while a narrow, sharp-pointed bistoury or tenotomy-knife is pushed through and run backwards and forward along the margin, thus cutting off a thin slice. The

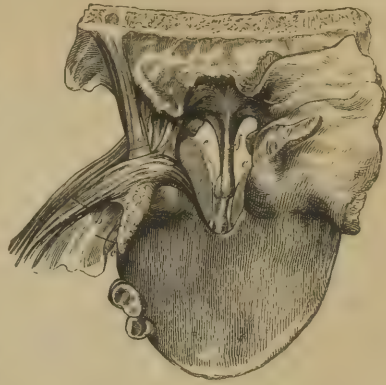
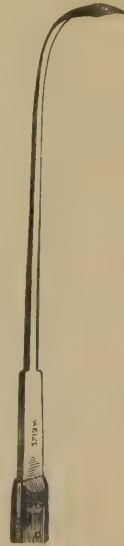


FIG. 352.

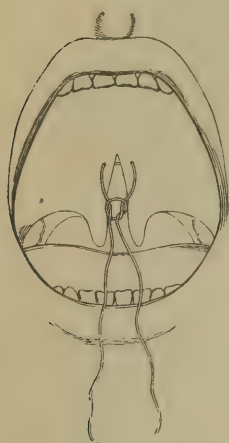


\* Posterior nares and upper surface of the soft palate.—*a*, levator palati; the dark line, shows the place for division. *b*, inner bundle of fibres of palato-pharyngeus, forming the posterior pillar of the fauces; the black line indicates the place for division. *c*, palato-glossus, with the mark for incision, if necessary. The tonsil lies between these two muscles. *d*, tensor palati, the cartilaginous extremity of the Eustachian tube is in front of this letter. *e*, posterior extremity of the inferior turbinate bone. *f*, the septum. *gg*, uvula on each side stretched apart. (Fergusson.)



introduction of sutures is best accomplished by the manœuvre attributed to Mr. Avery. A peculiar curved needle set in a handle, and armed with a smooth thread of the ordinary size for interrupted suture, is passed from below upwards about a quarter of an inch from the cut margin of the fissure, the thread is seized with forceps and drawn

FIG. 353.



as a double thread out of the mouth, with the single ends also hanging out; when the needle is withdrawn. A similar double thread is then passed from below upwards, through the other margin at the same distance from the cut surface and exactly opposite. Thus there is a double thread through each side of the fissure. One thread—the last passed—is now pulled out into a single thread, and the end which hangs through the fissure is passed through the loop of the other thread; when, by pulling the ends of this double thread, the single one is drawn through doubly; the traction thread is then withdrawn, leaving the other with both ends hanging out of the mouth. Two, three, or four threads are introduced in like manner; and then each is tied successively in a double knot reef (Fig. 353), but not too tightly, so as to secure the cut margins in even and easy contact. Sometimes, with all due precaution, a little puckered hole will remain at the junction

of the velum with the hard palate. It is, in my experience, better to leave this aperture than attempt to close it by another suture. In one such case, acting on the injudicious advice of a bystanding friend, the passage of an extra suture broke up the adjoining one, and spoilt the operation.

During these proceedings every manipulation affecting the palate should be clearly *seen*, whether as to dividing the muscles, paring the fissure, or passing and tying the sutures. Any step clumsily taken can scarcely be recovered, on a part hardly large enough to admit of any repetition. Hæmorrhage should be arrested, as may be required, by gargling with ice-water.

After the operation, the patient must neither talk nor eat solid food; although with the freedom of the velum from traction, as accomplished by Sir W. Fergusson's operation, a liberal amount of liquid nourishment may be allowed. The sutures may be left for six, eight, or ten days, and with seeming advantage; when removed, they must be carefully snipped and withdrawn through the newly adherent palate.

The results of this operation in the hands of Sir W. Fergusson have been most satisfactory; of fifty-five cases, all have been successful, but two, and they were exceptional cases. Mr. Avery, Mr. Quain, Mr. Gay, Mr. Walton, and other Surgeons, including myself, have practised staphyloraphy on the same principle. Mr. Thomas Smith has invented a highly ingenious gag for keeping the mouth open during the operation.

The operation for closing fissure of the *hard* palate, was introduced by Dr. Warren of Boston. It consists in paring off the fibro-mucous tissue—including the periosteum, as Langenbeck has particularly recommended—from the bones on each side of the fissure, by means of curved knives; and uniting the lateral flaps with sutures. Mr. Avery was very successful in this proceeding, and more recently Mr. Pollock has revived it.

Or, an artificial palate may be constructed, and worn with much advantage. Mr. A. Nasmyth brought forward this mode of treatment in 1845, and Mr. C. H. Stearns, at the same time in America. The palate or obturator is made of various materials,—a gold or ivory plate, caoutchouc, etc. Mr. Sercombe has brought this resource to such perfection, in its adaptation to very extensive clefts, as to render an operation more a matter of choice than of necessity, for the improvement of the voice and performance of deglutition. Obviously, no obturator should be worn continuously, which can obstruct the development of the jaw in childhood, nor cause absorption of the natural bone, and thus enlarge the fissure.

Perforations of the hard palate produced by necrosis, as the result of syphilis or injury, might be remedied by Warren's operation. But, generally, an obturator will more effectually close the aperture.

**DISEASES OF THE JAWS.**—The connexion of the Teeth and Gums with the Jaws renders it convenient to consider the Diseases of these parts *seriatim*.

**TEETH.**—*Inflammation* and *Abscess*, have been already sufficiently noticed under *Alveolar Abscess*.

**Necrosis.**—The Jaws are subject to Necrosis from at least three causes; Syphilis, Exanthematous poison, especially that of scarlet fever, and Phosphorus. The latter form of Necrosis occurs among those whose occupation exposes them to the fumes of phosphorus, as in the making of lucifer matches. Dr. Wilks, among British writers, appears to have first drawn attention to this source of necrosis,—in the Guy's Hospital Reports of 1846-47. In Germany, phosphorus-necrosis was recognised as early as 1839, by Lorinser, who published a paper upon the subject in 1845; and was followed by other authors.

The mode in which the necrosis is produced, seems to be by the entrance of phosphorus-fumes into the osseous structure of the jaws, through carious teeth or an open socket; the disease never arising when the teeth of the operatives are sound. The liability of the two jaws to this necrosis appears to be about equal, or with a slight preponderance against the lower jaw. Of 52 cases given by German authorities, 21 were of the upper jaw, 25 of the lower jaw; in 5 both jaws were affected, and 1 case is uncertain. The English statistics gathered by Mr. Salter point to nearly the same conclusions. Excellent specimens of the disease as affecting both jaws, are to be found in the Museum of St. Bartholomew's Hospital.

**Symptoms.**—The same symptoms arise, whatever be the cause of Necrosis; but in that proceeding from phosphorus, they are most marked. Toothache, intermittent at first, becomes continuous; the teeth loosen and pus exudes from the sockets. The gums are swollen and tender, and detached more or less from the alveoli. Swelling of the face takes place, to perhaps a considerable extent, so that if only one side of the jaw is affected, a peculiar lop-sided appearance results; one or more fistulous openings also discharge pus and lead down to bare and dead bone. The general health yields under the constant suffering, loss of food, and the poisonous influence of purulent matter swallowed daily.

**Terminations.**—Death may, at length, take place from exhaustion, or rapidly from gangrene of the cheeks and lips; recovery occasionally ensues, with considerable loss of bone and deformity. Repair after necrosis of the jaw is sometimes very complete, the formation of new bone being very prolific. A pumice-stone deposit of bone on the sequestrum is

almost constant, and has been regarded as characteristic of phosphorus-necrosis; but this, Mr. Christopher Heath affirms, is not necessarily connected with phosphorus. It is derived from the periosteum, and though resembling true bone, it is decidedly of lower development. This deposit is not found in the disease of the upper jaw. It would seem also not to be peculiar to phosphorus-necrosis, the pumice-like bone sometimes encrusting a sequestrum, which has resulted apparently from rheumatic periostitis; as shown by Mr. Perry's case in the *Medico-Chirurgical Transactions*, Vol. xxi. In a remarkable case recorded by Mr. Thomas Smith, in the *St. Bartholomew's Hospital Reports* of 1865, phosphorus-necrosis of the entire lower jaw was followed by restoration of the jaw. The new bone appears to be produced either from the periosteum, or from the surrounding soft parts when the periosteal membrane has lost its vitality; and in Mr. Smith's case, the reparation thence derived was sufficient to reproduce the jaw. In that case also, two other notable points were illustrated; the reparative material was formed not around, but entirely in front of or below the sequestrum, and there was an absence of pumice-stone deposit. The former condition, as pertaining to reparation, existed in the lower jaw of a patient, some years since, at the Royal Free Hospital; and from whom Mr. T. Wakley removed the sequestrum, which extended nearly from angle to angle of the jaw. I assisted in the operation, and particularly noted the form of reparation. Repair of the lower jaw seems to be but temporary; the new bone diminishing by absorption to a mere arch, and ultimately being scarcely sufficient to keep out the lower lip, the chin is quite lost. It is a question, how far this loss by absorption might be prevented by supplying the new jaw with a function through the means of artificial teeth?

*Treatment.*—The cause of necrosis must, of course, be removed; any exposure to the influence of phosphorus would perpetuate that form of the disease. Any decayed teeth or stumps should therefore be extracted, as the source of local irritation. Detergent gargles of chlorinated soda or permanganate of potash may be advantageously used to cleanse the mouth. Opium to allay pain, with tonics and whatever nutritious food can be taken to support the strength, are the only measures available pending the detachment of the sequestrum, and the production of an enveloping shell of new bone adequate to maintain the form of the jaw. The sequestrum is then to be extracted through the mouth, if possible, or through incisions placed so as to leave the least subsequent deformity. The permanent set of teeth should be preserved, when practicable. "Subperiosteal resection" has been much advocated by foreign Surgeons; as M. Rizzoli, Flourens, Maissonneuve, and Ollier of Lyons. This operation does not apparently differ from the extraction of sequestra, as ordinarily practised.

Prevention in the case of phosphorus-necrosis has been ably investigated by Dr. Bristow in Mr. Simon's Report to the Privy Council, 1863. Working with *amorphous* phosphorus is unattended with danger, for the disease arises exclusively from the fumes of common phosphorus.

*UPPER JAW.*—*Abscess of the Antrum.*—Arising from the irritation of carious teeth, which may be in immediate relation to the antrum, or unconnected with that cavity, as the incisor teeth; the disease commences as alveolar abscess, which bursts, directly or indirectly, into the antrum. But, abscess of the antrum may result from catarrhal or other inflammation of the lining membrane; or it may be of traumatic origin,—the



extraction of a tooth communicating with the cavity, the entrance of a foreign body, a blow on the cheek, or injury received during birth in a pubic presentation. An instance of the latter occasion of injury, having induced abscess of the antrum in an infant a fortnight old, is recorded by Dr. G. A. Rees in the *Medical Gazette* (N. S.), vol. iv.

The *symptoms* are, at first, those simply of inflammation of the lining membrane; dull, deep-seated pain shooting up the face and to the forehead, swelling and tenderness of the cheek, with considerable fever and constitutional disturbance. A slight rigor, sometimes, announces the formation of matter, which may find its way into the nostril, when the patient is lying on his sound side, either through the normal opening, or an opening resulting from absorption, as maintained by M. Giralès. Generally, the pus not finding a ready exit, distends the antrum; bulging out the cheek, uplifting the floor of the orbit, depressing the hard palate, and loosening the teeth, obstructing the nasal duct and closing the nostril. The wall of the cavity undergoes absorption, and becoming thinned, it yields a peculiar parchment-like crackling under pressure with the finger. The matter may burst externally, into the mouth, or into the nostril; in either case considerable necrosis and scar will probably be the result.

*Treatment.*—Any carious teeth or stumps must be extracted. This may be followed by a flow of pus, when the introduction of a trocar through the alveolus will completely evacuate the matter. When all the teeth are apparently sound; the first molar tooth should be extracted—as having the deepest socket and being most liable to decay, and then the socket must be punctured.

*Puncturing the Antrum.*—Care should be taken in using the trocar, lest it penetrate with a jerk and injure the orbital plate. The alveolus may be punctured above the gum, and this will be necessary in the rare case of suppuration occurring in old people, after loss of the teeth. The cavity should then be cleansed by syringing with warm water, by means of a curved canula and hydrocele elastic bottle. A slightly astringent injection may be advisable; and a weak solution of permanganate of potash or sulphate of zinc, answers admirably. The admission of any particles of food should be prevented, by plugging the aperture with cotton-wool; or, as Mr. Salter has suggested, by fitting a metal plate to the mouth with a small tube to fill the aperture, which can be corked at pleasure and serves as a pipe for injection. In puncturing the antrum, the possible subdivision of this cavity, owing to the existence of bony septa, will be an obviously important condition; and especially with reference to the extraction of a foreign body, as the fang of a tooth lodging in one of these subdivisions.

*Chronic abscess of the antrum*, producing a slow expansion of this cavity, may be mistaken for a solid growth, as Liston has seen happen; and particularly when there is considerable hypertrophy of the osseous wall in consequence of prolonged irritation, a condition which Stanley mentions as having occurred in the practice of Sir W. Lawrence.

*Dropsy of the Antrum.*—The symptoms are the same as those of abscess, only that the enlargement is painless, and more slowly produced. The fluid evacuated is a clear or yellowish serous fluid, and frequently contains flakes of cholesterine. This condition was formerly attributed to obstruction of the aperture between the antrum and nostril; thus allowing a gradual accumulation of the mucous secretion. It is now regarded as the production of a cyst or cysts within the antrum, or in connexion with

the fangs of the teeth,—dentigerous cysts, which either grow to such a size as to be mistaken for the cavity of the antrum when opened, or burst into the antrum leaving no trace of cyst-formation. Hence the character of the contained fluid, serous and not mucous.

The swelling of the cheek may subside, the jaw resuming its original size; and the discharge from a punctured alveolus ceasing, the aperture closes. Collapse of the antrum may occur, with absorption of the front wall causing a projection of the upper wall, in the form of a prominent horizontal ridge of bone immediately below the orbit. This remarkable deformity was found in the person of an old woman, a subject in the dissecting-room at King's College; and it was originally described by Sir W. Fergusson as probably an unique specimen.

Dropsy, like abscess, of the antrum, may be mistaken for a solid growth; and Mr. Heath notices a case in which a very able Surgeon removed the upper jaw before discovering the error of his diagnosis. An exploratory puncture will determine the question; as was shown in a very remarkable case of simulation which occurred in the practice of Sir W. Fergusson, and is recorded in the Medical Times, 1850.

Puncture of the antrum and evacuation of the fluid, is the only mode of cure; and this proved successful in the case last cited.

TUMOURS.—*Hyperostosis* or simple osseous hypertrophy, and various morbid growths or tumours, are liable to form in, or in connexion with, the Jaws, as in other parts. Thus, *fibro-cellular*, *fibrous* and *recurrent fibroid*, *cystic*, *cartilaginous*, *osseous* and *myeloid*, *vascular*, or *erectile*, and *cancerous* tumours may severally occur.

The pathology of all these morbid growths differs in no essential particulars from that of the same growths in other situations.

Their *diagnosis* demands some special notice. The differential characters of these tumours are, however, not well marked, and their diagnosis, there-

fore, is by no means unequivocal; but this difficulty is practically unimportant, excepting with reference to the distinction of cancerous or malignant and non-malignant forms of maxillary growths.

In examining any tumour of the *Upper Jaw*, a careful inspection and palpation, as far as possible, should be made of the face, mouth and nares. In making a rhinoscopic examination, the nares may be illuminated by the Laryngoscope. A small mirror is placed at the back of the throat, at such an angle that luminous rays falling on it are reflected into the nares, whilst the image formed in the mirror is seen by the observer. An antral tumour can thus be clearly distin-

FIG. 354.



guished from a polypus springing from the turbinate bones, or a growth springing from the base of the skull. The condition of the hard and soft palate should be examined with the finger, and behind the soft palate to ascertain any extension of the growth in that direction. The consistency of the projection beneath the teeth is more readily discovered, and the finger should be passed over it both outside and inside the cheek.

*Non-malignant* growths are more or less hard to the touch, and painless. They grow slowly, and have no tendency to involve surrounding parts or the skin, except by mechanical interference; the general health also remains unaffected. (Fig. 354.)

This represents a *fibrous* tumour, removed by Liston, and with a permanently successful result. Myeloid and vascular tumours are softer than other non-malignant growths, and more vascular in appearance where they are covered only by mucous membrane. They grow more rapidly, occasionally ulcerate, but do not fungate, as in fibrous tumours of the upper jaw, and may then bleed profusely. *Encephaloid cancer* is characterized by its softness, and gnawing pain affecting the face and head; its rapid growth, and tendency to fungate and bleed.

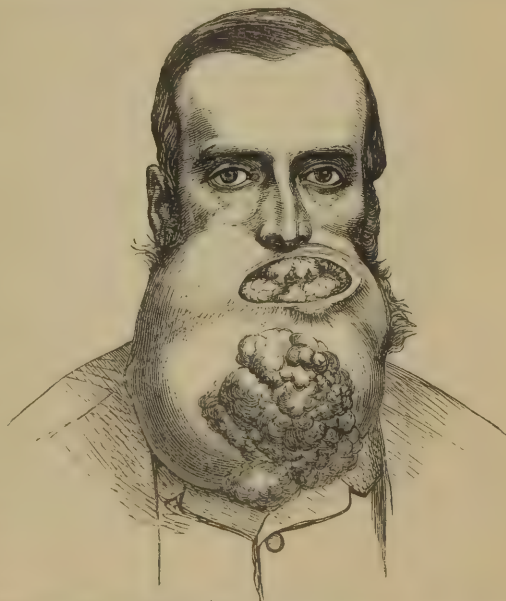
Tumours of the *Lower Jaw* are more open to diagnosis. *Non-malignant* growths are characterized by hardness and slowness of growth, with no tendency to fungate within the mouth and no enlargement of the neighbouring lymphatic glands. After a time, the unchecked growth may burst through the skin and present a fungating mass; but this has a more healthy appearance and is of slower growth than the encephaloid fungus. (Fig. 355 and Fig. 356.)

The former, was a case under the care of Sir W. Fergusson; operation was deemed unadvisable, owing to the exhausted state of the patient, and death ensued. The latter figure

FIG. 355.



FIG. 356.





represents a *fibro-cellular* tumour of monstrous size, in Mr. Heath's celebrated case; it was successfully removed, but death took place on the sixth day, from exhaustion. *Cancerous* tumours generally originate within the bone, and grow rapidly; tumours having these characters are almost invariably cancerous.

TREATMENT. — *Medicinal* treatment with the view of inducing absorption can be of little avail. A small enchondroma of the upper jaw is said to have been thus removed, under the care of Mr. Stanley, by the application of iodine.

Early and complete *excision* of the growth is the only cure; in non-malignant tumours, before the anatomical relations of the growth have become too complicated to admit of complete extirpation; in cancerous tumours, before the surrounding structures have become involved.

The results of such operations are more successful in respect to tumours of the lower jaw, as the whole disease can be more completely removed. What security there may be in the removal of half the jaw affected with cancer, is still an open question.

EXCISION OF THE UPPER JAW.—Of several methods of operation, that which is most generally applicable, is as follows:—The patient sitting, or lying recumbent and under the influence of chloroform, the central incisor tooth of the diseased jaw is extracted, and two incisions are then made. First, a bistoury is entered at the junction of the malar and upper maxillary bones, and carried down with a curvilinear incision into the angle of the mouth. Secondly, another incision is made from the nasal process of the upper maxilla down along the side of the nose, round the ala, which it detaches, and perpendicularly through the centre of the upper lip into the mouth. (Fig. 357.) The flap, thus defined, is dissected up to the

FIG. 357.



FIG. 358.



margin of the orbit, and its contents—the eyeball and its surroundings, cautiously raised from the floor of this cavity, protected by a curved spatula held by an assistant standing behind over the head of the patient. The bones are then divided by strong cutting-pliers (Fig. 358); the

junction of the malar bone first, then the nasal process, one blade of the pliers being inserted into the orbit—the eye still protected, and the other into the nose; and lastly, the alveolus is notched with a narrow-bladed saw, where the incisor tooth was extracted, and the palatine arch divided by passing strong, sharp-cutting, pliers (Fig. 359)—one blade into the mouth and the other into the floor of the nose. The palatine process of the palatine bone with the velum palati, or soft palate, should be left untouched, if possible. The osseous mass thus detached from its connexions, is drawn downwards and forwards, and easily removed. Ligatures must be applied to the facial and transverse facial arteries, or any other vessels which cannot be secured by torsion or pressure. The large cavity exposed is plugged with lint from the bottom, the flap of integument replaced over it, and retained in position by a few twisted sutures in the cheek and upper lip. No portion of integument should be pared off, however redundant it may at first appear; having been stretched over the osseous tumour, it will contract and pucker up. The ultimate disfigurement resulting from this operation is comparatively inconspicuous. (Fig. 360.)

FIG. 359.



The malar bone may be involved in the disease, with the whole of the superior maxilla; then the zygoma and junction of the malar with the external angular process of the frontal bone, must be divided externally, with the pliers, and the operation completed as for removal of the superior maxilla alone.

FIG. 360.

The malar bone and the orbital plate of the superior maxilla, forming the floor of the orbit, may be sound; then, a groove having been made with a small saw, across from the nasal process of the maxillary to the outer margin of the malar bone, the separation is completed with the forceps, including the remainder of the bone as above described.

*Modifications of this Operation* have been practised with success by Sir W. Fergusson.

(a) A transverse incision, slightly curved, may be made from the junction of the malar bone below the eye, across to the nasal process (Fig. 361), instead of curving downwards into the angle of the mouth. Considerable hæmorrhage will thus be avoided, and the other incision may be made as already indicated.

(b) A single incision from the angle of the mouth upwards and outwards, has enabled him to remove tumours of some size; or an incision through the centre of the upper lip to the base of the columna and into the nostril, has afforded sufficient space for the removal of tumours of such size as it would be deemed advisable to operate on.



EXCISION OF THE LOWER JAW.—*Partial* removal of this bone will generally suffice—the disease being situated on one side, and between the symphysis and angle of the jaw (Fig. 362), or involving the ramus, or extending beyond the symphysis to the other side.

FIG. 361.



*Complete* removal of the jaw, by disarticulation at the temporo-maxillary articulation, on either side, is rarely rendered necessary by the extent of the disease.

The plan of any such operation, partial or entire, is the same. The object is, to remove the diseased bone, with the most facility and least ultimate deformity. An incision under the chin, along the body of the bone and ramus, answers both purposes.

(1) *Partial excision*—say of one-half of the jaw, is performed as follows:—The point of a scalpel should be entered behind the articulation, and an incision carried down the posterior border of

the ramus behind the angle,

FIG. 362.



thence along under the body of the bone to the chin, and curving upwards, it terminates about an inch from the margin of the lip. In the



course of this incision, the facial artery will be divided, but the coronary is avoided. The former is at once ligatured. The flap is dissected up, thoroughly exposing the tumour, the knife passed under it into the cavity of the mouth and along the jaw, keeping close to the bone, and thus detaching the mucous membrane. The central incisor tooth of the diseased side having been extracted in commencing the operation, the jaw should here be notched with a small saw, having a moveable back (Fig. 363), and clipped through with cutting-forceps by a firm and snapping grip. Laying hold of the tumour with one hand, and moderately depressing the body of the bone, the Surgeon severs the attachment of the temporal muscle to the coronoid process by a light touch with the knife; then, the masseter muscle having been already detached in raising the integument, the articulation is entered from the front, and by carrying the knife round the condyle, with its edge closely turned towards the neck of this process to avoid wounding the internal maxillary artery, the pterygoid muscles are divided, and the excision completed. (Fig. 364.) This figure represents the half of the jaw, as a cystic tumour, removed by Sir W. Fergusson, from the patient in Fig. 362. Should the internal maxillary require ligature, the common trunk of this vessel and the temporal artery—the termination of the external carotid, will be found as it emerges from under the border of the posterior belly of the digastric muscle. The cavity is filled with lint, the flap replaced, and neatly retained with twisted suture.

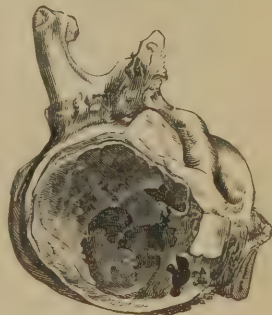
FIG. 363.



A *more partial* excision of the lower jaw—between the symphysis and angle, can be effected in like manner, the incision, under the body of the bone extending only between these two points, and the cutting-forceps being applied posteriorly at the angle, as well as at the symphysis.

FIG. 364.

*Beyond* the symphysis, the operation may be extended by continuing the incision, and applying the saw and forceps at the limit of the disease, on either side. Whenever the operation extends beyond the symphysis, necessitating a division of the muscles on either side, which pass from the jaw to the tongue, this organ must be secured and drawn forwards by means of a ligature previously introduced through the tongue, and thus held by an assistant. Otherwise, the tongue, loosened anteriorly, may be retracted into the pharynx—swallowed, in fact, and threaten, or actually occasion, suffocation.



(2) The *entire* jaw can be removed *en masse*, by an incision carried round, and a disarticulation corresponding to that for the removal of half the bone.

During the process of healing by granulation, the patient must be fed with liquid food, spooned into the mouth or sucked through a tube. A dense, fibrous tissue gradually forms a kind of substitute jaw; and, espe-

cially when the articulations are left untouched, the movements and appearance of the lower part of the face are far more perfect than might be expected. (Fig. 365.) It has often occurred to me, that some kind of

FIG. 365.



the overhanging multitude of students in the theatre—lives in my memory with the freshness of yesterday.

**CLOSURE OF THE JAWS.**—This condition implies more or less inability to open the mouth and to perform the act of mastication. It may be spasmodic or permanent.

(1) *Spasmodic* closure, sometimes of several weeks' duration, is almost invariably connected with difficult eruption of the wisdom-teeth of the lower jaw. Owing to want of space for, or mal-position of, the tooth, constant pressure thus occasioned, induces a state of tonic spasm of the masseter and internal pterygoid muscles.

The *treatment* consists in opening the mouth under the influence of chloroform, and with the aid of wedges or a screw gag; the second molar must then be extracted to make room for the wisdom-tooth, or the tooth itself may be removed.

(2) *Permanent* closure may be the result of several causes operating mechanically—profuse salivation, with sloughing of the cheeks and the formation of rigid cicatrices which draw up and hold the lower jaw closely and tightly against the upper—ankylosis of the temporo-maxillary articulations, in consequence of injury, or of arthritic inflammation; the formation of an osseous bridge between the jaws or the lower jaw and temporal bone, as a rare consequence of chronic articular arthritis—pressure of a neighbouring tumour, especially in the parotid region, so as to directly fix the joint. Besides interfering with mastication and articulation, permanent closure in early life is often followed by stunted development of the jaw, presenting a marked shortening of the chin and an oblique direction of the front teeth. With perforation of the cheek, there is a constant dribbling escape of the saliva, and the most disgusting disfigurement.

artificial supplementary jaw, with teeth, might be fixed upon the fibrous matrix, and when an appropriate opportunity occurs, I shall endeavour to put this notion into practice. My earliest recollections of these operations on the jaws date back to their memorable performance by Mr. Liston, at the University College Hospital; and, although nine-and-twenty years have elapsed since first I witnessed such an operation, the scene—ere the days of chloroform or ether—of the master operator, with his massive hand, snapping through the jaw-bone of the patient seated before him, the group of assistants, and

*Treatment* must have reference to the nature and situation of the cause of closure.

Rigid cicatrices may be relieved, not perhaps permanently remedied, by excision of the contracted integument; the patient wearing for months or years, the silver shields adapted to the upper and lower jaws by Mr. Clendon, or other suitable apparatus, to counteract the tendency to re-contraction. Ankylosis of the temporo-maxillary articulations may be overcome by mechanically breaking up the adhesions, under the influence of chloroform. An osseous bridge, connecting the jaws, can be severed and removed by cutting-pliers and a small saw; but this proceeding must be warranted by an accurate diagnosis. Any tumour which mechanically impedes the motion of the jaw may be extirpated, provided its anatomical relations to the parotid gland do not contra-indicate such operation.

The formation of an *artificial joint* in the lower jaw was originally suggested by Esmarch in 1855; followed by Rizzoli in 1857, who quite independently conceived a similar idea. The one, however, performed excision of the joint; the other simply cut through the jaw, without removing any portion of bone.

Esmarch's operation appears to be preferable, as facilitating the formation of a false, moveable joint. It was first performed by Dr. Wilms of Berlin, in 1858, and successfully; shortly afterwards by Esmarch, with equal success; and subsequently by Diltz of Vienna, and by Wagner of Königsberg. It was introduced into this country by Mr. Mitchell Henry, the patient sinking from pyæmia; a few weeks afterwards Mr. Christopher Heath performed the operation, and in two cases with the most satisfactory results. A small incision along the edge of the jaw exposes the articulation, when sufficient bone should be removed to give free motion, say half an inch, by means of a Hey's saw or the chain-saw.

Rizzoli's operation has proved successful in his own hands, in four cases, and it has been performed also by Professor Esterle. No external incision is made, but section of the jaw—not excision—is accomplished from the interior of the mouth, with powerful forceps. Both these operations have proved unsuccessful, owing to reunion of the divided jaw.

---

## THE NECK.

---

### CHAPTER XLV.

#### INJURIES OF LARYNX AND TRACHEA, PHARYNX AND ŒSOPHAGUS.

**LARYNX and TRACHEA.—WOUNDS OF THE THROAT.**—These injuries are inflicted commonly with suicidal intent, and usually therefore with a cutting instrument, as a razor or knife; forming the wound ordinarily known as cut-throat. This wound is a transverse and upturned incision, somewhat jagged or lacerated, and varying in depth and extent.

It may be a *superficial* wound, dividing only the integument, and to a limited extent, in front of the throat; or extend across the throat, from side to side, or ear to ear, and sever the carotid vessels—artery and vein, with perhaps the pneumogastric nerve—on one, or both sides, and if sufficiently low down in the neck, the phrenic nerve may be touched. An



integumental wound commencing on one side of the throat, may divide these vascular and nerve-trunks, on that side; but a wound sufficiently resolute to extend to the other side—cutting the throat, as it is popularly termed, from ear to ear—and dividing the vessels on both sides, will scarcely be effected without involving deeper parts.

A *deep* wound involves the air-passages, and perhaps the pharynx or œsophagus. The appearances and functional phenomena differ somewhat according to the situation of the wound. It may be *above* the *hyoid* bone; thus opening the mouth under the tongue, which perchance will be touched, and the power of deglutition is lost. Or, the wound may pass across the *thyro-hyoid space*, above the larynx, the commonest situation; opening the *pharynx*, and perhaps shaving off the epiglottis or touching the glottis itself, and here also deglutition is incomplete. Or, the *larynx* may be divided anteriorly, presenting a transverse gap, through which the air issues during each expiration, with a rushing, bubbling sound, and with almost sufficient force to blow out a candle if held near the aperture. The voice is lost or reduced to a broken whisper, but it is restored on closing this opening in the windpipe. Similar phenomena are observed when the *trachea* is opened. The *thyroid body* will be almost necessarily involved, an important source of hæmorrhage. The *œsophagus* can be opened only by a deeper wound, passing through the trachea. But, in rare instances, both the windpipe and gullet have been divided down to, and implicating, the *vertebral column* beneath. The windpipe is usually cut in front and high up, the suicide imagining that a wound of the air-passage is mortal; and thus the prominence of the larynx mostly invites the attempt. Hence also, the great vessels and nerves, on either side of the throat providentially escape injury.

*Consequences and prognosis.*—*Hæmorrhage* is the immediate source of danger. It may be venous; proceeding from the plexus in front of the trachea, or from the internal jugular vein. The carotid trunk or its branches are the source of arterial hæmorrhage; and the trunk must be wounded if the jugular vein be implicated. Death may speedily ensue, directly from hæmorrhage, or from the blood trickling into the windpipe, producing asphyxia, or inflammation of the lungs at a later period. Occasionally death arises from the accidental sucking up of air into the veins, inducing asphyxia. Division of a large nerve, the pneumogastric or phrenic, occurs usually in conjunction with wound of the larger vessels; and division of the phrenic on one side only may be almost immediately fatal, either by partially suspending respiration, or in consequence of inflammatory congestion of the lungs. *Asphyxia*, in connexion with, or as a consequence of cut-throat, may arise, as already stated, from hæmorrhage into the trachea, or from lesion of the phrenic nerve, or congestive pneumonia consequent on either state; but pneumonia or bronchitis is liable to ensue from the introduction of cold air into the lungs through the wound, the inflammation extending downwards from the aperture in the windpipe. *Edema of the glottis* in consequence of inflammation, or irritation or impaction of a partly detached epiglottis, may severally induce asphyxia, when the wound is above the larynx. Loss of the natural sensibility of the glottis, preventing its efficient closure, will allow food to pass into the larynx and through the external wound, without any wound of the pharynx or œsophagus. Accumulation of mucus in the bronchi is also apt to occur, in consequence of their diminished sensibility. *Lastly*, the respiration may be mechanically impeded below the

epiglottis; either by a partly detached portion of cartilage hanging into a laryngeal or tracheal wound, or by overlapping of the lower portion of the trachea by the upper portion, when this tube is completely divided.

*Treatment.*—The general indications are—to arrest hæmorrhage, to adjust the wound for reparation, to obviate any difficulty of respiration, to administer food, and to avert inflammation of the trachea, or lungs.

(1) *Hæmorrhage* must be arrested by the ligature of any bleeding vessel, whether artery or vein, so as to prevent any oozing or trickling into the larynx or trachea. The introduction of a silver tube into the windpipe aperture of the wound will obviate the liability of blood being sucked in by each act of inspiration. This should be withdrawn as soon as oozing hæmorrhage has ceased. (2) The *wound* should be adjusted by position, rather than by sutures. An *integumental* wound may be advantageously united by a few points of suture, throughout its extent. In a *deeper* wound, involving the windpipe, partial union only can take place, owing to the mobility of the parts subject to the actions of respiration and deglutition; the wound closes chiefly by granulation and cicatrization. If primary union happen to occur in the central part of the wound, coagula are apt to accumulate beneath, threatening suffocation, and the wound will have to be reopened for their removal. The extremities, or integumental portion of the incision, may be retained together by a suture or two, leaving the central portion open; the head should then be brought forwards, so as to depress the chin towards the sternum, and fixed in position by a bandage round the crown, with a lateral strip passing down on either side of the face, fastened to a band around the chest. If the trachea be completely divided, a suture or two should be inserted into each side of the *tube*, to retain its ends together. (3) Difficulty of *breathing* must be prevented or overcome, by having regard to the circumstances already enumerated which give rise to dyspnœa. The temperature of the apartment should be maintained at about 80° Fahrenheit; and the air moistened and softened, as it is breathed through the windpipe aperture, by covering the wound with a piece of muslin loosely folded, beneath which a clean sponge moistened with warm water may be placed adjoining the air-aperture. This aperture must be carefully kept open and free of any clot, or other occasion of impediment to the breathing. A wound above the larynx, and followed by œdema of the glottis, will necessitate recourse to tracheotomy. (4) The administration of *food* becomes a difficulty only when the pharynx or œsophagus is opened. Food is best introduced by means of a large-sized elastic catheter, or the tube of the stomach-pump, passed through the mouth into the gullet below the opening. If this mode of feeding cause great irritation, nutritive enemata may be resorted to. The food is necessarily liquid, but strong beef-tea, soup, or Liebig's *liquor carnis*, milk, eggs beat up with brandy or wine, can be thus administered, and the patient's life indefinitely prolonged, until he is able to swallow without assistance.

(5) *Inflammation*, in the form of bronchitis, will probably be averted by due attention, as already directed, to the temperature of the atmosphere which the patient breathes through the windpipe aperture; and pneumonia prevented by watchful observation, more especially with regard to any trickling hæmorrhage into this aperture. In the event of either form of inflammation, the treatment accordingly must be conducted on ordinary principles; taking however into consideration the state of the patient, as reduced by hæmorrhage and his depressed mental condition.

The wound, in the course of granulation, requires nothing more than water-dressing, or other simple applications.

*Aërial Fistula* sometimes ensues; the skin having doubled in and become adherent to the edge of the aperture in the air-tube, a jet of air passes and repasses through, with each act of respiration. This happens most frequently in the thyro-hyoid space. Mr. Erichsen has found the following operation successful in closing such a fistula. The edges of the opening are to be freely pared, and the knife passed under them for some distance to detach them from the subjacent parts, a vertical incision also being made through the lower lip of the opening, splitting it downwards. Two points of suture are then inserted into each side of the horizontal incisions, bringing their edges into contact; but the vertical cut is left free for discharges and mucus to drain away, and for the expired air to escape, lest emphysema occur. Unless this outlet be left, the sutures will burst, and union of the edges be frustrated. An aërial fistula cannot be safely closed when the larynx above is obstructed, and it may even become necessary to enlarge the opening and introduce a silver tube to compensate for the laryngeal obstruction.

FOREIGN BODIES IN THE AIR-PASSAGES—*Larynx, Trachea, or Bronchi*.—Various substances that admit of being swallowed, occasionally pass into the rima glottidis, and thence, perhaps, lower down into the air-passages; any such body is, however, not swallowed into the glottis, in an effort of deglutition, but *inhaled* into this opening from the mouth, by a sudden inspiration, in the act of laughing or talking with the substance in the mouth. It is drawn by the current of air between the dilated lips of the glottis. Various substances may thus pass the “wrong way”—a bit of meat, a cherry-stone, a bean, pea, nut-shell, or a tooth, money, a button, a bullet, pill, or pebble, a pin, fish-bone, or piece of stick.

The *Symptoms* are those of suddenly-obstructed respiration, and of irritation, followed by those of inflammation. But the symptoms vary in intensity according to the situation of the foreign body.

Impacted in the *rima glottidis*, any substance so placed completely obstructs respiration, and the individual, suddenly turning blue in the face, drops down dead almost instantaneously. Not uncommonly a violent explosive cough or two ejects the foreign body, and the peril is over, although spasmodic coughing still remains for a time, owing to the irritation. In the *larynx*, the foreign body may lodge or hitch in one of the ventricles, or slip down into the *trachea*; the same spasmodic coughing is evoked, with great difficulty of breathing and sense of suffocation, and pain referred to the episternal notch, a croupy sound is heard through the stethoscope, during respiration, but the voice is broken or lost. All these symptoms are most intense when the larynx is the seat of impaction; in the trachea, the foreign body has more room, and the urgent symptoms may subside for a while; or the foreign substance moving up and down occasionally, particularly if the patient move, coughing returns with increased violence, and the body may be heard and even felt to strike the larynx, seeming to threaten instant suffocation. In the *bronchi*, a foreign body is comparatively tolerated; the respiration is more or less embarrassed, and a whistling or murmuring sound may be heard over the seat of lodgment; sometimes also, during coughing, the body is dislodged and driven upwards. The right bronchus is generally that into which the foreign body falls; it being more directly in the middle line.

The *diagnosis* from laryngitis or croup, turns mainly on the history of



the dyspnœa; the apparent introduction of a foreign body, in the act of eating and laughing, for example, and the sudden origin of the symptoms from that occasion, constitute the chief points of distinction.

*Consequences.*—Inflammation of the larynx, trachea, bronchi, or lungs, supervenes in a variable period; a few days, or an indefinite time elapsing after the more urgent symptoms of dyspnœa have subsided. Cough, pain, and muco-purulent, perhaps bloody, expectoration, succeed; and they continue until the patient is worn down in a few months, or a year or two, and dies from hectic exhaustion. Rarely, the foreign body may be coughed up again; in one instance, Heckster relates that a ducat was thus ejected after two years and a half imprisonment; in another case, Tulpus states that a nut-shell was coughed up after a lodgment of seven years; the patients in both cases recovering. Sometimes, death ensues, although the body has been ejected; as in an instance given by Sue, in which a pigeon-bone was spat up seventeen years after its introduction, the patient dying about a year afterwards from marasmus.

The *prognosis* depends on the size and physical character of the foreign body, and the period of its incarceration. Mr. Erichsen finds that, after the immediate danger, the greatest risk occurs between the second day and the end of the first month, no fewer than 11 patients out of 21 having died during this period; but that the mortality diminished until the third month, when it increased again. The cause of death also varies according to the period of the fatal result. During the first twenty-four, or forty-eight hours, it happens from convulsions and sudden asphyxia; during the first few weeks, it is apt to occur from inflammation of the lungs; and after some months have elapsed, death results from hectic exhaustion.

*Treatment.*—The obvious indication is to get the foreign body out of the windpipe; but the proceeding to be taken should be guided by the urgency of dyspnœa. (1) Impaction in the *rima glottidis*, will demand—when opportunity offers—immediate search below the root of the tongue with the finger, and extrication of the substance from the chink of the larynx. Failing to accomplish its removal, laryngotomy must be performed immediately, and a probe passed through the laryngeal aperture into the larynx to dislodge the foreign body. (2) Lodgment within the *larynx*, or *trachea*, may allow of some delay; in order to quiet spasm of the laryngeal muscles which prevents the ejection of a body, not otherwise itself too large to be coughed up. With this view, it may be desirable to bring the patient somewhat under the influence of narcotics, or chloroform. Inversion of the body—by holding the patient with his heels upwards and head downwards, shaking the body at the same time or slapping the back, will probably cause the substance to drop out of the air-passage and escape through the mouth. A child can be readily held, head downwards; but, for a grown person some mechanical contrivance may be necessary, such as was used in the case of the eminent engineer, Mr. Brunel, when he accidentally swallowed a half-sovereign. If suffocation threaten, the attempt must be abandoned.

*Laryngotomy* or *tracheotomy*, should be resorted to without delay, in the event of the foreign body still remaining in the windpipe. The respiration is thus set free, and the irritability of the laryngeal muscles subsides; so that the substance may be expelled through the larynx, or more probably through the artificial aperture. Sometimes, it can be safely extracted, or made to drop out by inversion.

The *results* of cases, as left to nature or subjected to treatment, are well shown by the statistical facts collected by Professor Gross, respecting 159 cases of foreign bodies in the air-passages. Spontaneous expulsion occurred in 57, 8 terminating fatally. Inversion of the body alone was successful in 5 cases, and unsuccessful in 6. In 68 cases, tracheotomy was performed; 60 lived and 8 died. In 17, laryngotomy was practised; 13 lived and 4 died. In 13, laryngo-tracheotomy was performed; and of these, 10 recovered and 3 died. It thus appears, that of the 98 cases in which the windpipe was opened, for the removal of foreign bodies, 83 were successful, and 15 fatal,—or the deaths were in the proportion of 1 to 5½. Of the three kinds of operation, tracheotomy was most favourable, the deaths being only in the ratio of 1 to 8½; whereas after each of the other two operations, the proportion of deaths was twice as great. The most frequent cause of death was inflammation of the lungs.

SCALDS OF THE GLOTTIS, MOUTH, and PHARYNX—not unfrequently occur among the children of the poor, in their attempting to drink from the spout of a kettle, containing boiling water. The act of swallowing is not complete, but the inside of the mouth and pharynx are scalded, and œdema of the glottis is speedily induced; the interior of the larynx remaining unaffected. (Fig. 366.) A similar state may be produced by the inhalation of flame in the explosion of gas or fire-damp.

FIG. 366.



The *symptoms* are, immediate and urgent suffocative cough, and difficulty of breathing; and the appearances are, puffed and turgid lips, the interior of the mouth and fauces having a whitened and soddened aspect. Death soon ensues, unless the inflammation be subdued.

*Treatment*.—Leeches to the throat, and small doses of calomel and opium, may succeed in reducing the œdema; but the urgency of the dyspnœa will probably necessitate tracheotomy without delay, as the only chance of safety; and a tube must be introduced into the tracheal aperture and retained there, until this has subsided under the continuance of remedial measures. The operation is rendered more than usually difficult, by the shortness, fatness, and turgidity of the neck, and small size of the trachea. Having performed the operation several times, under these circumstances, I can confirm the opinion of those Surgeons who regard it as only an unavoidable alternative between death and the possible preservation of life, and that the result is generally fatal, from the super-vention of bronchitis or pneumonia.

ASPHYXIA or APNŒA.—These terms are synonymous only by usage, as being understood to signify want of breath; their etymological meaning is widely different, the one signifying an absence of pulse (*à* not, *σφύζω*, I beat); the other, an absence of breath (*à* not, *πνέω*, I breathe). Apnœa should, therefore, correctly speaking, be the term selected to designate the various forms of suspended or impeded respiration; but the term Asphyxia has, by association, become so familiar that I here employ it as having that meaning.

*Symptoms*.—Dyspnœa or difficulty of breathing, as indicated by the

respiratory movements; which, at first short and rapid, soon become deep, forcible, and prolonged, with a gradually widening interval between them, until just before they entirely cease, when they again diminish in force and duration. The circulation of blood undergoes concurrent changes; the heart's action, at first accelerated, in a few seconds becomes slow, laboured, and feeble, till the pulse ceases to be perceptible at the wrist. The heart, however, still beats, audibly to the ear, and palpably to the hand, applied to the chest; this action gradually becomes less and less distinct, till it entirely stops at a period within ten minutes after the first interruption to the respiration. The period that elapses between the last respiratory effort and the cessation of the heart's action, varies from two to four minutes. Cerebral symptoms accompany the circulatory changes, and in somewhat the following order:—a sensation of fulness in the head and giddiness, singing in the ears, and flashes of light dancing before the eyes; then follow pleasing almost voluptuous dreams, which soon fade away into insensibility and unconsciousness, speedily succeeded by convulsions. The *appearances* of the person undergoing asphyxia are peculiar;—an extremely anxious expression of countenance, blueness of the lips, starting of the eyeballs, distension of the vessels of the face, head, and neck, frothy mucus, occasionally sanguineous, about the mouth, involuntary passage of the feces and urine, and sometimes an emission of semen with or without erection.

All the symptoms are modified and proceed more or less rapidly, according to the cause of asphyxia.

*Post-Mortem Appearances.*—The *external* appearances depend on the period after death,—in the course of twelve hours, any characteristic appearances will mostly have passed off; and they are modified by the cause of fatal asphyxia. At an *early* period,—within three or four hours after death, lividity of the lips, with oozing froth, and perhaps slightly sanguineous mucus are conspicuous; lividity and swelling of the tongue, which presents impressions of the teeth upon its margin, may also be observable; the eyelids are half open, and the pupils dilated; but the countenance is generally placid and pallid, or faintly livid. These appearances, however, resemble the facial aspect of death from epilepsy; or they may, in part, proceed from heart-disease, concussion of the brain, and perhaps other causes of death. Rigor mortis sets in early, and particularly after *drowning* in ice-cold water. The hands are clenched, sometimes so firmly in the drowned, as to be opened only by great force, even to cause fracture of the finger bones. Death resulting from asphyxia mechanically induced, usually leaves some marks of violence, such as ecchymosis or laceration at the seat of injury. There may be the mark of a cord upon the neck after *hanging*, or of fingers on the neck after throttling; the hyoid bone also is sometimes fractured, or the cartilages of the larynx are dislocated. The *internal* appearances consist chiefly of venous congestion of certain organs, with a proportionally anæmic condition of other organs. The heart and great vessels present great engorgement with black blood, on the right side, in both the auricle and ventricle and extending to the large vessels connected therewith; the left side of the organ generally being empty, or containing venous blood as on the right side. The blood throughout the body has a venous tint, and is sometimes found in a fluid state. The portal system is greatly engorged, and thence the liver and spleen more especially. The kidneys partake of the general venous congestion. The lungs are not so entirely nor in-



variably congested as has been asserted in most works; and the brain,—according to the results of experiments on animals, by Ackermann,—is always in an anæmic condition; the cerebral vessels becoming congested merely as the mechanical result of the post-mortem distribution of the blood, in consequence of a dependent position of the head. Extravasations of blood within the cranium, occasionally result from injury to the head in the mode of death.

Death by *drowning* presents one peculiarity in the state of the air-passages and lungs; these organs contain water, or other foreign matter, as mud, duckweed, &c.; there being no exclusion of foreign matter by spasm of the glottis, as was formerly supposed. This admission of foreign matter is established by the observations of the Committee of Inquiry appointed by the Royal Medico-Chirurgical Society, and whose Report appeared in the Transactions, 1862.

The *causes* of asphyxia may be arranged under four general heads; (1) A mechanical impediment to the entrance of air into the lungs; (2) drowning; (3) the absence of oxygen in the respired gas; (4) inhalation of a toxic vapour, associated with an absence of oxygen. The following tabulated view—constructed by Dr. George Harley—presents, at a glance, a very useful enumeration of the particular causes of asphyxia, comprised under each of these general modes of causation.

*Asphyxia may arise from—*

1st. Mechanical Impediment to the Entrance of Air into the Lungs.	Accident.	External.	{ Pressure on the trunk preventing the expansion of the chest; throttling; garotting; strangulation by a cord; hanging; smothering, by covering the mouth and nostrils, imbedding the face in earth, feathers, wool, &c.; paralysis of the respiratory muscles from injury to the spinal cord, or to the base of the brain; double penetrating wound of the chest, admitting air.
		Internal.	{ Choking from a morsel of food or other substance blocking-up the fauces; plugging of the trachea by a cherry-stone or other substance; constriction of the fauces and injury to the glottis from application of corrosive and irritating fluids.
	Disease.	External.	{ Pressure on the trachea from an aneurism or other tumour.
		Internal.	{ Edema of the glottis; tumour on or about the vocal cords; false membrane blocking-up the air-passages, as in diphtheria or croup; bursting of an abscess or aneurism into the trachea; double pneumonia or pleurisy; accumulation of mucus in the bronchial tubes; apoplexy at the base of the brain or in the medulla oblongata, causing paralysis of the pneumo-gastric, and of the respiratory muscles.
	2nd. Drowning . . . . . { In any liquid of whatever nature—water, wine, beer, or brine.		
	3rd. Absence of Oxygen in the respired gases. { Inhalation of pure nitrogen, hydrogen, or any other innocuous gas.		

4th. Inhalation of a toxic gas or vapour.	{	In which death is erroneously attributed to Asphyxia.	{	Carbonic acid, carbonic oxide, coal-gas, choke-damp, ammonia, chlorine, sulphuretted hydrogen, arseniuretted hydrogen, antimonuretted hydrogen, sulphurous acid, nitrous acid, hydrocyanic acid, vapour of chloroform, ether, amylene, or any other volatile product.
---	---	---	---	---

*Treatment.*—The primary indication is to arterialize or oxygenate the blood as soon as possible; this implying the restoration of respiration, and circulation—by certain resources, any adverse condition having been previously removed.

*Artificial Respiration.*—This may be effected by various apparatusless means, and which, therefore, are always applicable.

(1) By simultaneous pressure on the abdomen and thorax, alternated with relaxation, twenty or thirty times *per* minute. The compression should be made over the lower part of the sternum and upper and middle part of the abdomen, so as to partially expel the air from the thorax, without allowing any counteractive effect by descent of the diaphragm; the resilience of the thoracic walls enables the air to rush into the lungs, and then compression is repeated. If food be forced up from the stomach, the patient should be placed on his face for a few seconds, while any such matter is expelled, lest it pass into the wind-pipe.

(2) *Marshall Hall's method* — or the “ready method” — consists essentially in turning the body gently on the side and half prone, and then briskly on the face, alternately; and in making pressure along the back of the chest each time the body is brought into the prone position. This method has been largely practised and has proved very successful in restoring respiration. Yet its efficacy was not so favourably reported by the Committee of the Royal Medico-Chirurgical Society, the whole amount of exchange of air sometimes not exceeding a few cubic inches, and never exceeding 15 cubic inches.

(3) *Silvester's method*—or the “physiological method”—consists in the imitation of the natural action, as during deep inspiration, of the pectoral and other muscles passing from the shoulders to the walls of the chest. Inspiration is imitated by slowly extending the arms upwards by the sides of the head until the elbows nearly touch each other; expiration is then performed by simply restoring the arms to the sides of the chest, and pressing them against it, or pressure on the lower part of the sternum will have the same effect and more readily than lateral pressure with the arms. This method seems superior to Marshall Hall's in two important elements; the *first* step in the restoration of breathing is a movement of expansion to a chest already in a state of expiration; and *both* sides of the chest, are left uncompressed and free to expand. The quantity of air thus exchanged often exceeds 30 cubic inches, and in one instance amounted to 50 cubic inches.

*The circulation.*—Restoration of this function is partly effected by that of respiration—by arterialization of the blood and the respiratory movements. But certain special means of stimulation should also be resorted to; such are warm frictions all over the body and more especially on the limbs; warm coffee or tea, and brandy, when the patient can swallow, should be administered, or previously by the stomach-pump, and stimulant enemata also prove serviceable; also a warm-bath, not above 106° Fahr., when the temperature of the body is much reduced, as by

drowning in the winter season. Artificial respiration by pressure can be readily applied while the body is in the bath.

As soon as the natural respiratory movements recommence, artificial respiration may be discontinued, or renewed only to aid the efforts when feeble and imperfect.

*Treatment after natural Respiration.*—The following directions are appended by Dr. Harley.—(1) Give the patient some warm nutriment, to which a small quantity of stimulant is added; beef-tea, chicken-soup, coffee, or tea with one or two tablespoonfuls of brandy. (2) Put him into a well-aired bed with hot bottles to his feet, and encourage sleep. (3) Let him be carefully watched during sleep in case of secondary apnœa; at the slightest symptom of which let gentle frictions, and, if necessary, artificial respiration be again had recourse to. Give volatile stimulants, such as the spiritus ammoniæ aromaticus, or sp. atheris nitrici.

In the case of the *drowned*, the following might be said to be the four golden rules of treatment:—(1) Empty the air-passages of all the water and frothy mucus they may chance to contain, by holding the legs and trunk higher than the head. (2) Wipe the mouth and nostrils dry. (3) Draw forward the tongue. (4) Use artificial respiration.

**PHARYNX and ŒSOPHAGUS.**—*Wounds* of the gullet occur, most frequently, in connexion with cut-throat, as a complication of this form of injury.

*Foreign Bodies.*—Various substances are liable to become impacted in the pharynx or œsophagus; some of which obstruct the passage by their size, as a lump of meat; others impinging, by their pointed shape, as a fish-bone. The former substances stick, either in the pharynx, about opposite the larynx, where the tube is narrowed at the commencement of the œsophagus; or, low down towards the cardiac orifice of the stomach.

The *symptoms* are those of choking and suffocative cough, with turgidity and blueness of the face; and the foreign body can probably be felt on introducing the finger into the pharynx. If unremoved, asphyxia may soon prove fatal. Low down in the œsophagus a similar obstruction produces equal difficulty in the passage of anything swallowed, though not any difficulty in the act of deglutition itself; and a sense of oppression with pain about the top of the sternum, but the degree of actual suffocation will depend on the pressure of the impacted body on the trachea. The substance can be detected by the introduction of an oiled-probang, carefully passed down to the seat of obstruction.

Small pointed bodies commonly lodge in some fold of mucous membrane, behind the root of the tongue, between it and the epiglottis, or in the sides of the pharynx. Any substance so placed is felt by the individual, more particularly in the act of swallowing; and it may perhaps be seen, or felt with the finger.

*Complications, and Consequences.*—Rupture of the gullet has occurred, owing to the violence of impaction, or in consequence of ulceration with the formation of abscess in the cellular texture around the tube. Fatal hæmorrhage also has ensued. In a remarkable case, at the University College Hospital, many years since, a street-juggler passed, as usual, a long, round-ended sword down his throat; when he suddenly sprang into the air and fell in a state of collapse. In this state I saw him, on being brought to the Hospital; a loose emphysematous crackling could be dis-



tinctly heard, and even felt, under the sternum in the anterior mediastinum, during each hurried respiration. The poor fellow soon died, then it was found that the sword had obliquely perforated the œsophagus and pericardium at the base of the heart. As assistant-curator of the Museum at that time, it became my duty to make a preparation of this interesting specimen, which with the sword placed by its side in a long glass jar, is preserved in the Museum.

*Treatment.*—The foreign body impacted, must either be extracted or pushed down into the stomach; but which of these two proceedings may be proper will depend on the situation and nature of the substance.

In the *pharynx*, any kind of foreign body should be extracted, if possible. The patient being seated, with his head thrown back and mouth wide open; the Surgeon introduces his forefinger straight into the pharynx and searching for the substance, hooks it up with his finger, or by a hook-probang, (Fig. 367), or removes it with curved forceps guided by the finger. A pointed foreign body, as a fish-bone or a pin, must be withdrawn very carefully, lest it lacerate the pharynx. When any such body has been removed, a pricking sensation will still be experienced by the patient for a while. Low down in the *œsophagus*, an impacted foreign body may commonly be pushed into the stomach by means of a probang, (Figs. 368, 369), used gently; or perchance, by directing the patient to swallow a large mouthful of bread. But a rough substance which would

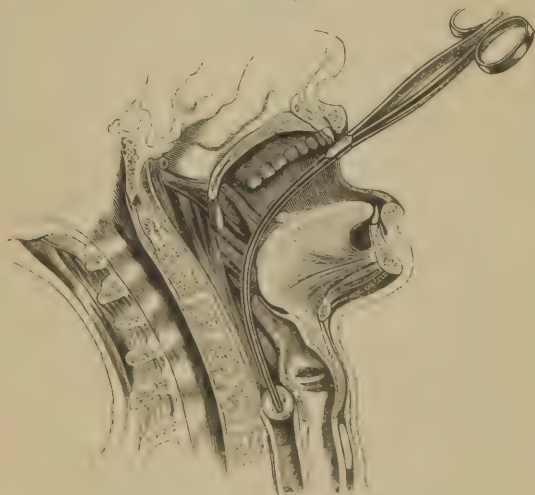
FIG 367.



FIG. 368.



FIG. 369.



thus rupture the œsophagus, or one of a metallic or other kind unsuited to the stomach, had better be drawn up gradually by the probang or forceps. Sometimes, an emetic will succeed in dislodging and ejecting the substance; or it has been dissolved, as in the case of a chicken bone, by swallowing large quantities of dilute acid. This, however, is obviously an objectionable proceeding.

All other means having failed, *pharyngotomy* or *œsophagotomy* must be resorted to for the extraction of the impacted substance.

Asphyxia may be so urgent that it will be absolutely necessary to perform *tracheotomy*, before attempting to remove the foreign body from the œsophagus. Generally, however, the attempt may be made at once; and thus I succeeded instantly in pushing a lump of gristly steak into the stomach of an elderly lady, who lay back on a sofa gasping for breath and was already black in the face.

**PHARYNGOTOMY and ŒSOPHAGOTOMY.**—These operations consist in opening the gullet at one or other part; either for the removal of an impacted foreign body, or occasionally in stricture, for the purpose of conveying food into the stomach.

The left side of the neck is usually selected, the œsophagus inclining rather to this side is there more accessible. An incision is made of sufficient length along the anterior border of the sterno-mastoid muscle, betwixt it and the trachea. The skin, platysma and cervical fascia having been divided, the dissection is carried directly backwards, avoiding the carotid sheath and larynx or trachea. The omo-hyoid muscle may be divided, but the thyroid arteries should, if possible, be avoided in this deep dissection. Having reached the pharynx or œsophagus, a bougie, sound or catheter, had better be passed through the mouth into the cavity, and made to project as a guide on which to cut the opening into the gullet. The aperture may then be enlarged, either by dilatation with forceps, or by further incision with a blunt-pointed bistoury, to an extent sufficient for the extraction of the foreign substance, or for the introduction of a feeding-tube.

## CHAPTER XLVI.

### DISEASES OF PHARYNX AND ŒSOPHAGUS; LARYNX AND TRACHEA.

**FAUCES.—TONSILS and UVULA.—TONSILLITIS.**—Acute inflammation of the tonsil, or ordinary “sore-throat” is denoted by diffused redness and rapid swelling of the tonsils, which may almost meet, leaving only a chink between them. Commonly only one tonsil is affected. Pain, at first not acute, but rather as if the part had been bruised, is diffused over the back of the mouth and much increased by any attempt at swallowing; tenderness also is felt in the side of the neck and under the angle of the jaw. The saliva accumulates in the mouth and dribbles away, the patient holding his mouth slightly open as if to relieve the sense of strangulation, and he speaks with a thick, nasal voice. The tongue is loaded with a creamy fur, and the breath fœtid; there is considerable throbbing head-

ache, and rather sharp fever. The state of the tonsils is readily seen on opening the mouth, by simply laying a spatula or the handle of a spoon on the tongue, which gradually contracts backwards, thus fully exposing the fauces. This practical hint for examining the throat is due to Mr. Pollock; depression of the tongue provokes a steady and firm effort of resistance, and thereby increasing the natural tendency of the organ to arch up when the mouth is opened, the tonsils can scarcely be seen.

The *causes* of acute tonsillitis seem to be exposure to cold in conjunction with some constitutionally disordered state of health, as a gouty habit, or disorder of the digestive organs. Frequently one tonsil being inflamed, the other becomes affected, and the individual is subject to recurring tonsillitis, usually on the same side.

The inflammation *terminates* in resolution, or not unfrequently in abscess, but rarely in childhood, apart from scarlet fever, and seldom in old age. Suppurating tonsillitis is more incident to youth and middle life.

*Treatment.*—Local measures consist in hot fomentations or a mustard poultice from ear to ear, and the inhalation of the steam of hot water; scarification of the tonsils may also be resorted to for the relief of congestion. But any constitutional state of the general health must be rectified, and without much lowering treatment. Abscess should be opened early,—as soon as a white speck in the tonsil becomes visible; and carefully, by a knife of limited or protected cutting edge,—not to wound the lips or tongue, and in puncturing the abscess, the edge should be turned towards the middle line, never outwards,—thus to avoid the risk of wounding the internal carotid artery outside the tonsil. The relief obtained is very great, and the inflammation soon subsides; leaving, however, the patient much pulled down, considering the shortness of the attack.

**CHRONIC ENLARGEMENT OF THE TONSIL.**—Resulting from repeated inflammation, this hypertrophied condition of the tonsil occurs mostly in children of a scrofulous constitution, and more commonly in females. Insidious and painless, the enlargement produces no symptoms otherwise than those arising from the mechanical occlusion of the tonsils. Hence, some difficulty of swallowing and breathing, the child snoring at night, and awaking in alarm; the voice is muffled and there is more or less “throat-deafness”; the intensity of these symptoms depending on the size to which the tonsils attain.

Ulceration frequently supervenes from time to time, and occasionally acute inflammation. The breath is often offensive, owing to decomposition of the sebaceous secretion accumulated in the crypts of the gland, or of the thick semipurulent mucus clinging to the fauces.

*Treatment.*—Constitutional measures are far more effectual than any topical applications. A general tonic plan of treatment, in the form of steel wine or the other preparations of iron, bark, cod-liver oil, and a nutritious, well-regulated diet. Sea-bathing is often most advantageous. Stimulating applications, as by nitrate of silver or gargles, can scarcely affect the condensed areolar or fibrous tissue of which the enlarged mass consists.

*Superficial Excision* of the tonsil is the only efficient local remedy; but it had better be reserved for an extreme state of chronic enlargement, when any of the already mentioned symptoms have become most inconvenient or detrimental to the general health. The mouth being held wide



open and the tongue gently depressed, the tonsil may be seized with a vulsellum, but not drawn out of its bed, and a thin slice removed with a protected blunt-pointed bistoury (Fig. 370); or the same partial excision

FIG. 370.

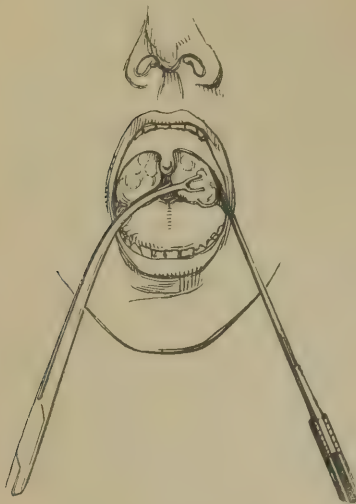


FIG. 371.



can be performed by means of a guillotine (Fig. 371). I prefer the latter, especially in children, in whom, although the mouth is comparatively small for the introduction of the instrument, yet it is a steadier mode of excision. Both tonsils may be operated on at the same sitting. Iced water will arrest the hæmorrhage; pressure and styptics of perchloride of iron or of turpentine may be necessary to stop any unusual or persistent bleeding.

The gland remaining after operation, shrinks eventually into its bed; the cut surface contracting by cicatrization.

**ELONGATION OR RELAXATION OF THE UVULA.**—Thickening, without elongation, of the uvula sometimes occurs; but an elongation or relaxation without thickening is the more common state. It appears to consist of an excess of mucous membrane, the azygos muscle not participating in the hypertrophy; and the membrane may extend an inch beyond the extremity of the muscle, hanging down as a thin narrow slip of this tissue, with a pointed extremity. When of this length, it dips into the pharynx and touches the aperture of the larynx. Constant irritation occasions a spasmodic cough, while tickling of the fauces excites nausea or even vomiting. The patient's life is sometimes thus rendered quite miserable. An elderly gentleman, otherwise remarkably hale and hearty, spoke to me of his depression as being intolerable.

The cause of this hypertrophy generally seems to be an habitual over-exertion of the voice, which probably throws in action the uvula. Hence its elongation is not uncommon among clergymen and barristers; not a few of whom, whether eminent preachers or advocates, are subject to this complaint. It arises also mostly in those of a gouty diathesis.

*Treatment.*—Stimulants and astringents topically applied have some beneficial influence. Nitrate of silver freely applied once or twice; or cayenne pepper, or alum, occasionally, blown through a quill on to the uvula, may prove useful. Tonic treatment of the general health is an important adjunct. The apparent causes adverted to must, of course, be removed when circumstances permit. Relaxation still continuing in spite of any such remedial measures; a portion of the pendent uvula must be cut off. This may easily be done by seizing the extremity with polypus-forceps, and snipping off with blunt-pointed scissors, so much as to leave the stump of the natural length of the uvula. A combination of forceps and scissors—an instrument of American invention—has been used for this purpose; thus holding and cutting the uvula simultaneously. This method is the same in principle as the removal of a nasal polypus with my “scissor-forceps.”

**TUMOURS OF THE VELUM PALATI.**—(1) *Fibro-cellular* tumour is usually attached to the free border or upper surface of the soft palate; having a pendulous, painless character, and being of slow growth, it may be discovered only when mechanically inconvenient by dropping down below and behind the root of the tongue.

This tumour can be removed with forceps and scissors; care being observed to snip it off at the pedicle, or as near as can be reached.

(2) *Cysts*, mucous or sebaceous, are sometimes met with in the soft palate; containing respectively, a thin glairy fluid, or yellowish-white fatty matter.

They must be laid open by a free incision, and their interior touched with a stick of nitrate of silver twirled round within the cyst, or with a probe dipped in nitric acid.

*Abscess* of the velum presents a globular swelling of the whole palate, accompanied by the red blush, and pain of inflammation. It must be opened early and freely with a sharp-pointed, protected bistoury.

**PHARYNX and ŒSOPHAGUS.**—**PHARYNGITIS.**—Inflammation of the pharynx, occurring generally as a continuation of a similar condition of the fauces and soft palate, but rarely as an independent affection, has an erysipelatous and diffuse character. It often terminates in purulent infiltration of the sub-cellular tissue, and even sloughing of the mucous membrane.

The *treatment* is similar to that of phlegmonous erysipelas; swabbing the pharynx with nitrate of silver and the employment of chlorinated gargles, must be reinforced by the administration of quinine with mineral acids, and as much nourishment and internal stimulants as can be got into the system. Laryngotomy may have to be performed, owing to œdema or spasm of the glottis rapidly supervening and impending suffocation. But, when purulent infiltration has taken place with considerable swelling, extending perhaps down the œsophagus to its cardiac end; swallowing becomes impossible, and recovery is almost hopeless.

*Abscess* occasionally forms in the cellular texture behind the pharynx, as a result or cause of some disease of the cervical vertebræ, or from ulceration of the pharyngeal mucous membrane by the impaction of a foreign body, as shown by a specimen in the Museum of St. George's Hospital.

The *symptoms* are difficulty of deglutition, and perhaps dyspnœa owing to pressure on the larynx; or nasal intonation, if the posterior nares be occluded. On examining the interior of the pharynx, a tense fluctuating

swelling may be seen and felt. This must not be mistaken for a polypoid or other solid growth of the walls or cavity of the pharynx. Pharyngeal abscess may burst into the mouth, or extend downwards under the sternomastoid muscles and present in front of the neck.

The *treatment* is simply evacuation of the matter by a well-timed and well-placed puncture with a sharp-pointed protected bistoury. The pus discharged has an offensive smell, not unlike that of a rectal abscess.

*Ulceration* of the pharynx is usually a manifestation of Syphilis or Scrofula, and as such, it forms part of the general pathology of these diseases, with the treatment accordingly.

**TUMOURS.**—*Fibro-cellular, fibrous, and fatty* tumours of the pharynx, are occasionally observed; giving rise to the symptoms of abscess—difficult deglutition, and perchance impeded respiration, with a swelling presenting in the pharynx, and perhaps in the neck. The characters of this swelling and its antecedent history will be the grounds of diagnosis. Practically, the particular kind of growth is less important than the size, shape, position, and attachment of the tumour. The pedunculated character generally prevails in pharyngeal tumours. *Epithelial* cancer is sometimes met with, in the usual flattened patches of this form of malignant growth.

The *treatment* of any pharyngeal tumour must be early removal by operation—a proceeding of much hazard, and necessarily restricted to the pendulous form of growth. Laryngotomy may have to be performed, prior to drawing the tumour forwards over the larynx and excising it through the mouth. Pharyngotomy might be preferable to this double operation, if the tumour be thus more accessible.

**STRICTURE OF THE ŒSOPHAGUS.**—This condition may be the result of certain distinct diseases of the œsophagus, producing a contracted state of this tube; which is commonly designated *organic* or permanent stricture to distinguish it from *spasmodic* stricture of the œsophagus.

(1) *Organic* stricture may be of *traumatic* origin—a *cicatrix* resulting from ulceration produced by the impaction of a foreign body, or occasioned by swallowing some acrid poison, as sulphuric acid; the latter mode of origin giving rise to a valvular *fold* of the mucous membrane, as in intestinal stricture consequent on dysentery. *Diseased* conditions comprise *fibrous* thickening, and *cancerous* thickening of the œsophagus. The cancer may be epithelial, medullary, villous, or colloid, and somewhat in this order of frequency.

*Symptoms.*—At first, a slight dysphagia or difficulty is experienced in the passage of solid food to the stomach. This increasing, the patient restricts himself to fluid food. At length, fluids are sipped only a few drops at a time, and perhaps partially rejected. Constant hunger, tortures the patient by day and night, yielding, however, at last to loss of desire for food; rapid emaciation and declining strength ensue. If ulceration takes place, expectoration of a semi-purulent and offensive secretion denotes this change, the breath also becoming perceptibly fœtid.

The cautious introduction of an œsophageal bougie will declare the existence of a stricture; the bougie comes to an obstruction or passes with difficulty. The *kind* of stricture must then be determined. Fibrous stricture presents a limited and smooth extent of contraction; no pus or blood follows the withdrawal of the instrument, but simply mucous discharge; there is no tumour in the neck, no cancerous enlargement of the cervical glands, nor cachexia. Carcinomatous stricture differs or contrasts



in all these particulars; a larger and irregular surface of contraction, through which the bougie passes roughly; pus and blood or the latter more especially, with shreds of tissue, follow the withdrawal of the instrument; while an elongated tumour is generally found at the root of the neck, with cancerous enlargement of the cervical glands, cancer also in some other part or organ, and cancerous cachexia.

(2) *Spasmodic* stricture is distinguished by the intermittent character of the contraction; it being sometimes present, sometimes absent, and situated rather in the pharynx than the œsophagus. The dysphagia intermits, and seems to be influenced mainly by the patient's attention being directed to or diverted from the complaint; the other symptoms—hunger, emaciation and loss of strength are far less pronounced. It occurs mostly in hysterical females. The introduction of a bougie is at first resisted, but the stricture soon yields under gentle pressure; and there are none of the additional and distinctive symptoms of fibrous or cancerous strictures.

*Dysphagia* may be *unconnected* with stricture, but dependent on some extrinsic cause or causes which diminish the calibre of the gullet by compression or obstruction. Such are; tumours connected with the pharynx; morbid conditions of the larynx—*e.g.* œdema; tumours in the neck; aneurism of the aorta or of the innominate artery; intra-thoracic tumours; dislocation of the sternal end of the clavicle backwards; impaction of a foreign body in the gullet. The diagnostic differences of these various causative conditions may be gathered from other sections of this work, pertaining thereto.

*Treatment.*—*Organic* stricture, of whatever kind, is incurable. *Dilatation*, by means of bougies, increasing in size, may afford partial and temporary relief. But the risk of perforating the œsophagus should be remembered, a risk proportionate to the structural disorganization and contraction of the passage; and this fatal misadventure has happened in the hands of the most skilful Surgeons. The instrument has been known to find its way into the mediastinum, into the cavity of the pleura, or into that of the pericardium. The principal use of a bougie is to determine the existence of a stricture, its situation and nature, and thus to complete the diagnosis of this affection; due caution being observed in passing the instrument.

When the result of cicatrix, or supposed folds of mucous membrane, caustic has been applied.

Nutritive enemata will tend to support the strength and prolong life; while washing out the mouth with whatever fluid is most relished, and swallowing perhaps a little of it from time to time, proves an agreeable occupation to the patient. In cancerous stricture, laudanum, or other anodynes administered in the enemata, will assuage the additional sufferings of this condition.

*Spasmodic* stricture is amenable to the general constitutional treatment of Hysteria. Large doses of assafoetida have been very advantageously employed by Dr. Garrod.

*Gastrotomy* or the operation of opening the stomach by an incision through the abdominal walls, has been performed, for the purpose of directly introducing food into the organ, when the œsophagus is impassable. Practised principally by Sédillot, Fenger of Copenhagen, Cooper, and Forster; the first-named authority thus performs this operation:—The patient lying on his back, the Surgeon standing on the right side,

makes a crucial incision, each line of which is about one inch and a half in length, on the left side of the mesial line of the abdomen; two fingers' breadth to the inner side of the costal cartilages, and about one-third nearer to the ensiform cartilage than to the umbilicus—having previously satisfied himself by percussion and palpation that the liver is not in his way. The dissection is carried through the abdominal wall, and the peritoneum opened. Then feeling with his left index finger for the left border of the liver, by following this upwards, the stomach is reached. The organ is seized with forceps, drawn forwards, and its structure recognised. The anterior wall of the organ is then fixed to the edges of the integumental aperture, by three or four points of suture, and an opening made into it about midway between its two extremities and a little above the lower margin. When, in the course of a few days, union of the wall of the stomach to the parietal peritoneum has become securely established, nutritive injections are administered through a silver tube passed into the artificial aperture, and which is thus kept patent. The value of this operation has yet to be decided by the results of further experience.

**PARALYSIS OF THE ŒSOPHAGUS.**—This affection occasions inability of swallowing; but it is unattended with spasm or pain, and the introduction of a bougie meets with no obstruction. It generally depends on centric disease, either of the brain or spinal cord. Cure will, therefore, probably be impossible.

*Treatment* consists in the administration of nourishment by the stomach-pump, or enemata. Electricity has sometimes proved temporarily beneficial. Strychnia and other nervine tonics might perhaps be tried with advantage.

**DILATATION AND SACCULATION.**—These conditions of the œsophagus are of rare occurrence. Instances of the former have been recorded by Rokitsky in his *Pathological Anatomy*, and by Dr. Barker in the *Pathological Society's Transactions*—tenth volume. A remarkable specimen of sacculation is preserved in the Museum of University College; it was the first preparation I put up on becoming Assistant-Curator. The mucous membrane protrudes through the fasciculi of the muscular coat in the form of very distinct pouches.

The *symptoms* of either structural condition are marked dysphagia, of a mechanical kind, the food lodging more especially in the pouches of a sacculated œsophagus. The ingesta seem to stuff in the chest, without reaching the stomach, and a portion is soon vomited, or rather ejected from the œsophagus.

*Treatment* cannot be curative. Feeding by the tube of the stomach-pump, or per rectum, is the only resource.

**USE OF THE STOMACH-PUMP.**—The flexible tube of this apparatus is to be introduced cautiously down the back of the pharynx and œsophagus; a gag, with a hole in it, having been placed in the patient's mouth, for the easy passage of the tube without any compression by the teeth. The stomach is then injected moderately full with water by working the pump, a pint or two being thus thrown in, and then pumped up again by reversing the action of the instrument. Care must be observed not to withdraw the whole quantity injected, lest the mucous membrane of the stomach be sucked up into the apertures of the tube, as would happen if the stomach were empty. Water should be thrown in and withdrawn, until it returns colourless and the stomach is completely washed out. Emetics are generally preferable to this artificially mechanical mode of

evacuating the stomach, whenever vomiting can be *excited*, assisted by freely swallowing diluents.

Such is the application of the stomach-pump in cases of *poisoning*. Its application for the administration of liquid *food* is similar, only that the liquid is simply injected and not withdrawn.

**LARYNX and TRACHEA.—LARYNGITIS.**—Inflammation of the larynx is attended with more or less urgent dyspnœa and aphonia or loss of voice, with difficult deglutition; which are proportionate to the effusion and swelling.

*Acute* laryngitis affects principally the mucous membrane of the larynx; the variety *Œdematous* laryngitis affecting chiefly the sub-mucous cellular tissue, especially of the glottis.

*Chronic* laryngitis, resulting in thickening of the mucous membrane of the glottis and over the back of the thyroid cartilage, is attended, more particularly, with aphonia or various modifications of the voice, as hoarseness, squeaking or broken voice, and with tickling, spasmodic cough. This form of the disease is common among clergymen, barristers, and public singers; and it goes by the name of "Clergyman's sore-throat."

*Consequences.*—The usual consequences of inflammation may follow laryngitis; abscess, sloughing and ulceration of the mucous membrane, possibly caries and necrosis of the cartilages of the larynx.

*Diagnosis.*—Visual examination of the larynx can be made directly, by seating the patient opposite a good, clear, white light, depressing the root of the tongue with a spatula, and requesting the patient to draw a deep breath. The laryngoscope supplies the means of completely exploring the larynx. Its application will be explained in connexion with the Treatment of Laryngeal Affections.

**SPASMODIC AFFECTION** of the larynx is accompanied with dyspnœa and other symptoms of laryngitis, thus simulating this disease. But the symptoms are less urgent, and also intermittent. This affection occurs not unfrequently in children, as spasmodic croup; and in adults, especially young hysterical females. It may also be concomitant with Laryngitis, or a sympathetic affection resulting from irritation or pressure on the laryngeal nerves by aneurism or tumour.

**TUMOURS.**—Polypi, fibro-cellular, fibro-plastic, or epithelial, and attaining perhaps to the size of a hazel-nut, may be attached to the epiglottis or to the mucous membrane within the larynx or trachea.

The *symptoms* of any such polypoid growth are; hoarseness or other modification of the voice, tickling, spasmodic cough, and increasing dyspnœa. But the difficulty of breathing varies, in the same case, at different times; fits of suffocation coming on, whenever the tumour, if attached to the epiglottis, is drawn down by inspiration, or, if within the larynx, it is driven up between the rima glottidis by expiration. A valvular flapping sound, heard or felt, during respiration, is the most distinctive symptom. The tumour, or a portion of it, has occasionally been coughed up, thus determining the diagnosis. Laryngeal growths are more fully described in Sir Duncan Gibb's well-known special work on Diseases of the Throat, &c., and in the Jacksonian Prize Essay on the Pathology and Treatment of Diseases of the Larynx, by Dr. Morell Mackenzie.

**THE LARYNGOSCOPE.**—This is an instrument for obtaining a view of the interior of the larynx during life. The construction of the apparatus in its present form, as fitted for the art of laryngoscopy, is due to Professor Czermak of Pesth; but the history of the laryngoscope dates back indi-



rectly to M. Lerret, a distinguished French accoucheur, who in 1743, invented a laryngeal speculum or mirror. Subsequently, other names are more or less associated with this invention; Bozzini in 1804, and Senn in 1827; while Dr. Benjamin Guy Babington in 1829, brought out the first laryngoscope, or glottiscope as he named it; a laryngeal mirror combined with another mirror, held in the operator's hand, as the means of illumination. Bennati, in 1832, asserted his ability to see the vocal cords with an instrument devised by Selligue, a mechanic; whose contrivance was "a double-tubed speculum, of which one tube served to carry the light to the glottis, and the other to bring back to the eye the image of the glottis reflected in the mirror, placed at the guttural end of the instrument." Baumès in 1838, Liston in 1840, and Dr. Warden in 1844, were each successively associated with the art of laryngoscopy; and in 1844, the late Mr. Avery devised a laryngoscope whereby artificial light was made the source of illumination. In 1854, M. Maunul Garcia conceived the idea of employing mirrors for studying the interior of the larynx during singing, and by autoscopic examination. In 1857, Dr. Türk of Vienna, endeavoured to employ the laryngeal mirror, alone, in the wards of the General Hospital; and later in the same year, Czermak completed the construction of the laryngoscope, and brought it into use in practical medicine.

The foregoing historical sketch is gathered from Dr. Morell Mackenzie's excellent work on the subject; and the following descriptive account of the instrument and method of using it, is derived from the same source.

The laryngoscope consists of two parts: (1) a small mirror fixed to a long slender shank, which is introduced to the back of the throat; and (2), an apparatus for throwing a strong light, solar or artificial, on to the small mirror. For thus projecting the luminous rays, most laryngoscopists employ a second, larger mirror, which reflects the light from a lamp or the solar rays. When artificial light is employed, this illuminating mirror is slightly concave; when sunlight is used, its surface is plane.

The only principle concerned in the art of laryngoscopy is the optical law, that when rays of light fall on a plane surface, the angle of reflexion is equal to the angle of incidence.

*Laryngoscopy* is thus performed:—The patient should sit upright, facing the observer, with his head inclined very slightly backwards. The observer's eyes should be about one foot distant from the patient's mouth, and a lamp burning with a strong clear light is placed on a table at the side of the patient, the flame of the lamp being on a level with the patient's eyes. The observer puts on the spectacle-frame with the reflector attached, in front of his forehead, and directing the patient to open his mouth widely, endeavours to throw a disk of light on to the fauces, so that the centre of the disk shall correspond with the base of the uvula. This projection of a luminous disk on to the back of the throat requires some practice, and it may be facilitated by inclining the reflector at a suitable angle before putting on the spectacle-frame. The tongue of the patient should now be protruded, and held if necessary between the thumb and finger enveloped in the corner of a towel, to secure the hold; the observer then introduces the laryngeal mirror to the back of the throat, having previously warmed its reflecting surface slightly over the chimney of the lamp, in order to prevent condensation of the expired air. This introduction of the mirror, so as to avoid producing faucial irritation, is

a *manœuvre*—as the projection of a luminous disk on to the fauces might be called a *caput æneæ*—which requires some nicety of manipulation and practice. The handle of the mirror being held like a pen, it should be introduced quickly to the back of the throat, its face directed downwards, and away from the tongue; the posterior surface of the mirror should rest on the uvula, which is pushed upwards and backwards towards the posterior nares. The observer, raising his hand a little, and directing it outwards, towards the corner of the mouth, the inclination of the mirror is thus altered and its face brought more towards the perpendicular, while the hand is kept entirely out of the line of vision. But this rotatory movement should be effected slowly, so that it can be arrested directly the larynx comes into view. Ambidexterity is very desirable in introducing the laryngeal mirror, and absolutely essential in the application of remedies to the larynx. The patient should then be taught himself to hold out his tongue.

TREATMENT OF LARYNGEAL AFFECTIONS.—*Laryngitis* must be met by the ordinary treatment of Inflammation, promptly applied; blood-letting, by means of leeches to the larynx, being especially applicable in the *acute* form of the disease, and less freely in the *œdematous* variety; while in both, calomel should be administered speedily to affect the system, and thus arrest the inflammatory effusion which perils suffocation. Antimonial salines are useful antiphlogistic adjuncts. *Chronic* laryngitis is principally amenable to the topical application of a solution of nitrate of silver.

*Spasmodic* Affections of the larynx will mostly succumb to the treatment of Hysteria; but when such an affection is sympathetic of some remote source of irritation, it may be irremediable. In one instance, many years since, a young woman was gasping for breath, and seemed so nearly on the point of asphyxia, that I was induced to have immediate recourse to tracheotomy; but, having made the incision through the skin only, over the trachea, respiration suddenly became free and the purple flush of the face disappeared; I at once discontinued the operation. When the bowels had been thoroughly evacuated of scybalous matter, and this source of intestinal irritation removed, the dyspnœa never returned.

*Polypoid tumours* of the larynx, illuminated by the laryngoscope, have been removed by various operative procedures. Sir Duncan Gibb has succeeded in casting a loop of thin silver-wire around the base of such a growth, situated just within the true vocal cords, and then detaching it by tightening the wire-ends drawn through a canula. Previous administration of the bromide of ammonium, in full doses, seemed to have the power of lessening the sensibility of the pharyngeal mucous membrane, and thus facilitating this operation. Dr. Walker of Peterborough, and M. Moura-Bourovillov in Paris, have also removed these laryngeal growths.

*Application of a Laryngeal Probang*.—Chronic laryngeal affections, principally of an inflammatory character, are much relieved or cured by the topical application of a solution of nitrate of silver, varying in strength from two to four scruples, and usually the latter proportion, to the ounce of distilled water. This can be applied by means of a laryngeal probang, consisting of a thin whalebone rod curved towards one end, to which is firmly secured a small, round, compressed piece of sponge. The mouth of the patient being opened, and the root of the tongue depressed with a

curved spatula; the sponge end of the probang, dipped in the solution, is passed down to the larynx, and the diseased part swabbed as much as may be necessary.

Can an instrument enter the larynx? is a question which has elicited considerable investigation and provoked much discussion; occupying a large proportionate space in one or two Text-books of Surgery.

A special Commission of the New York Academy, appointed to investigate this question, arrived at the conclusion:—"That there is no reliable evidence that the sponge-probang has been ever passed through and beyond the vocal cords."

Other modes of applying nitrate of silver have been proposed and occasionally practised. Injection of a solution by a laryngeal syringe has the advantage of gaining access to the interior of the larynx, or it can be applied to the pharynx or thrown up behind the velum and into the posterior nares. Inhalation of nitrate of silver in powder can be effected by means of a glass tube bent at one end, into which a small quantity of the nitrate—one part to ten or twenty of sugar having been placed—the tube thus charged is introduced into the mouth and directed over the epiglottis, the orifice of the straight part of the tube being closed with the finger. On raising the finger, and the patient making a sudden inspiration, the powder is drawn out of the tube into the larynx.

**LARYNGOTOMY and TRACHEOTOMY.**—The windpipe may be opened by surgical operation; either to establish Artificial Respiration for a time, or occasionally, to remove a foreign body from this tube. According to the situation of making the artificial aperture, the operation is designated: Laryngotomy, when the crico-thyroid membrane is thus opened; Tracheotomy, when the trachea is the seat of operation.

The various conditions of injury or disease which cause a mechanical impediment to the respiration, and which may require either of these operations for relief, have been noticed in other parts of this work.

*Laryngotomy* is very readily performed. The head of the patient being thrown back, the depression between the thyroid and cricoid cartilages is easily touched with the point of the finger. A vertical incision is made in the middle line, about an inch long, with a narrow-bladed, pointed bistoury or scalpel; this incision passing between the sternothyroid muscles, a cross cut through the crico-thyroid membrane, at once enters the air-passage. The air rushing in and gushing out of the aperture, and the immediate freedom of the respiration, shows that the object of the operation is accomplished. A curved laryngotomy tube of suitable size should be introduced, and retained by tapes fastened around the neck. Very little hæmorrhage occurs, but a small branch from the superior thyroid artery, running across the membrane, may be divided and require torsion or ligature.

*Tracheotomy.*—This operation consists in cutting down upon the trachea, in some part of its extent, and then dividing two or three of its cartilaginous rings; a more difficult and perhaps dangerous proceeding than laryngotomy, particularly if the neck be short and fat, the veins turgid, and the trachea deep, small, and restless,—moving up and down with each effort of hurried and forcible respiration. All these adverse conditions attend the operation in children.

The head being thrown back, an incision is made exactly in the middle line of the trachea, about an inch and a half to two inches long, extending from the lower margin of the cricoid cartilage downwards nearly to



the top of the sternum (Fig. 372). The skin, superficial fascia and fat, are thus divided; the opposed margins of the sterno-hyoid and sterno-thyroid muscles are then separated with the scalpel, and the veins in front of the trachea drawn out of the way to either side; any unusual artery discovered by its pulsation under the finger is also avoided. The isthmus, or connecting central portion of the thyroid body, may have to be drawn upwards; if wounded the hæmorrhage thence arising might be very troublesome.

FIG. 372.



A tenaculum or sharp hook is dipped into the upper part of the trachea, which is thus drawn a little upwards and steadied on the stretch; then, taking advantage of a favourable moment of exposure, the Surgeon penetrates the knife, with a slight jerk, into the lowest exposed portion of the trachea, and carrying a small incision upwards divides two or three of the cartilaginous rings of this tube.

FIG. 373.



The air rushing in and out again, shows that the windpipe is opened; but special care should be taken to avert any oozing of blood, arterial or venous, into the trachea; and a curved tube of a conical shape, flattened laterally as recommended by Liston (Fig. 373), should be introduced into the tracheal aperture, of sufficient size to completely fill it, and allow of free respiration, without, as Trousseau remarks, any whistling noise.

FIG. 374.



The introduction of the tube is sometimes attended with difficulty, owing to the elasticity of the tracheal rings partially closing up the aperture in making the attempt. One side of the incision in the trachea may be held aside with a hook, while the tube is slipped in; or the aperture

may be made and expanded with M. Garin's trachea-forceps dilator (Fig. 374); or Dr. Fuller's bivalve tube (Fig. 375) can be readily introduced,

FIG. 375.



closed, and a canula passed through it. A *double* tube is always preferable to a single one, especially if there be much expectoration; the inner tube can be taken out and cleansed. The tube is retained by tapes round the neck. Whenever the patient wishes to cough or speak, he must be instructed to close its orifice with his finger.

The final removal of the tube is determined by two events; the establishment of natural laryngeal respiration, and the cessation of any oozing hæmorrhage which might trickle into the tracheal aperture. When the tube is withdrawn the wound heals more or less readily.

The removal of any *foreign body* from the larynx or trachea must of course be effected before passing in the tube, in either of these operations, if undertaken for this purpose. The exact situation of any such substance having been ascertained by passing a probe through the artificial opening in the windpipe, forceps of suitable size and shape are then cautiously inserted and the body extracted.

The various difficulties in connexion with tracheotomy have been sufficiently adverted to in the above description; but certain modifications of the operation may be noticed. They relate to the mode of *opening* the trachea by means of different instruments. Sir H. Thompson has devised a *tracheotome*: an instrument with two blades, joined by a hinge at one end, and at the other bent down at an angle and furnished with cutting edges, so nicely adapted together, that when compressed by a screw above, they form one edge. The point is introduced *transversely*, between the first and second rings of the trachea, the blades are separated by reversing the screw, making an opening sufficient for the passing in of the tube, and the tracheotome is withdrawn. A bent *tracheal trocar* and *canula* has been used; but this mode of proceeding is decidedly objectionable, by depressing the trachea without readily penetrating it and then entering with a plunge.

## CHAPTER XLVII.

### DISEASES OF THE THYROID GLAND. THE PAROTID GLAND. TUMOURS OF THE NECK.

**THYROID GLAND.**—(1) **BRONCHOCELE OR GOÎTRE.**—This condition is an enlargement of the thyroid body, existing in one of three forms:—as *hypertrophy* of the proper structure of the thyroid, or *simple* bronchocele (Fig. 376); cysts imbedded in the substance of the gland, containing a glairy or bloody fluid, and perhaps bearing indigenous growths on their interior, forming *cystic* bronchocele; or as an enlargement of the thyroid vessels in and around the gland, constituting a vascular swelling, or *pulsating* bronchocele, and as being associated with an unnatural prominence or protrusion of the eyeballs and anæmia, this form of the disease is sometimes known as *exophthalmic* bronchocele. The state of the eyeballs has been referred

to an enlargement of the eye itself, Dr. Stokes attributing the prominence to an increase of the vitreous and aqueous humours; but it is generally referred to some morbid condition of the structures in the orbit, behind the globe,—effusion of serum, increase of post-ocular fat and cellular tissue, congestion of the orbital veins, or other allied cause. Combinations of these three conditions of bronchocele not unfrequently occur; cysts may be associated with hypertrophy, or vascular enlargement with cysts.

FIG. 376.



*Symptoms, and Diagnosis.*—Certain appearances and phenomena are common to all three forms of the disease. A swelling, corresponding in situation and shape to the thyroid gland, is presented in front of the neck; and which has a soft elastic character. Usually, both lobes of the gland are affected, and the tumour is bilobular; rarely, however, equally so; the right lobe is commonly the larger; occasionally, the middle lobe or isthmus is principally affected. The tumour always follows the movements of the trachea to which it is attached, and of the œsophagus as connected therewith; the swelling therefore rises upwards towards the chin when the patient is directed to swallow, and then lowers again to its original position as the act of swallowing ceases. This rising and falling of a tumour in the neck during deglutition is diagnostic of bronchocele from any other tumour, not implicating the thyroid gland, or directly attached to the trachea. When bronchocele has attained to a large size, this phenomenon is less observable, and therefore less characteristic. The skin over the tumour is not discoloured, or in an otherwise unhealthy state.

The *mechanical* results of pressure on surrounding parts are proportionate to the size of the tumour. Difficulty of breathing, especially in a stooping posture, and of swallowing, or dyspnœa and dysphagia, with some congestion of the brain, arise from pressure on the trachea, œsophagus, and jugular veins; hacking cough also ensues from a diseased condition of the trachea itself.

*Cystic* bronchocele is distinguished from simple hypertrophy of the thyroid or ordinary bronchocele; by tension and fluctuation in the cystic portions of the enlarged gland, and by a somewhat specially lobulated character, where the cysts partially project. The most marked instance of this form of the disease I ever saw, was in the Norfolk and Norwich Hospital, when I happened to visit that institution in the autumn of 1868. The patient, a young woman, was the subject of an enormous cystic bronchocele, which occupied the whole front and depth of the neck; extending laterally upwards from near the angle of the jaw on either side, downwards towards the clavicle, and from almost the level of the chin to the sternum. The whole mass looked like a pillow in front of the neck, tucked up under the jaw. The cysts were large, plainly fluctuating, and prominent.

*Pulsating* bronchocele is thus distinguished from ordinary goitre:—The size of the tumour varies considerably with the general condition of the patient as to rest or excitement, and their effect on the heart's action; the tumour rarely becomes large enough to produce any great deformity; and the purring thrill and loud murmur in the tumour,



with jerking of the carotids, and the general symptoms,—palpitation of the heart and prominent eyeballs, will complete the diagnosis.

*Causes.*—Common bronchocele, hypertrophy of the thyroid gland, occurs mostly in women, and commences about the age of puberty, in this country. It is frequently associated with some derangement of the menstrual function, and with an anæmic state of the general health. Hence the females affected have a pallid, weak, miserable appearance. Pregnancy alone not unfrequently induces enlargement of the thyroid gland. Endemic influence is remarkable; the disease prevails in Derbyshire, Nottingham, and the chalky parts of England; in the valleys of the Alps, Apennines and Pyrenees. In Savoy, Switzerland, the Tyrol and Carinthia, there are villages in which all the inhabitants, without exception, have these swellings. The hygienic cause, generally assigned under these circumstances,—the use of melted snow or of water impregnated with calcareous or earthy particles, is not established with regard to the localities most productive of the disease. But it does arise in low, damp situations chiefly, and under hygienic circumstances favourable to anæmia and debility. The disease is often associated with cretinism and idiocy; seeming to have an hereditary character in imperfect physical and mental development.

Pulsating bronchocele is said to be independent of endemic influence. Injury to the neck has sometimes been noticed as an exciting cause of bronchocele, a twist or strain of the neck having, apparently, given rise to the disease.

*Terminations.*—Recent enlargement of the thyroid gland may disappear under treatment; but the disease is of very chronic character, and when it has continued for some years, it is mostly incurable. The pulsating form of bronchocele is apparently urgent, yet it very rarely proves fatal; unless accompanied with organic disease of the heart; dilatation and hypertrophy, particularly affecting the left side of the heart, and perhaps thickening of the auriculo-ventricular valves.

*Treatment.*—The *hygienic* conditions productive of the disease, must if possible, be changed; the patient being removed from a low damp situation to a more airy locality. *Medicinal* treatment should have reference principally to the constitutional condition—anæmia. Iron, particularly the sulphate, may be administered with marked benefit, and Dr. Murnay speaks highly of strychnia; but the curative efficacy of iodine was first shown by Dr. Coindell; and shortly afterwards Dr. Fyfe of Edinburgh discovered the presence of iodine in burnt sponge. Originally given as thus prepared, the iodide of potassium is now commonly prescribed. Topically also, iodine ointment or that of the iodide of lead, may be rubbed into the tumour with advantage; or the emplastrum ammoniaci cum hydrargyro can be applied. Generally, however, all local applications are comparatively useless. A seton has been employed successfully by Mr. Hey of New York.

*Ligature* of the thyroid arteries, as the nutrient vessels, has been had recourse to. The difficulty and danger of this operative proceeding, its very questionable results, and the probability of other arterial branches becoming enlarged; constitute serious objections thereto.

*Pulsating* bronchocele would be most appropriately treated by ligature. Injection of perchloride of iron has been serviceable, subject to the risk of considerable inflammation, suppuration, and pyæmia supervening.

*Cystic* bronchocele may be tapped here and there, and injected with

tincture of iodine, in order thus to induce inflammation and adhesive obliteration of the cysts.

Excision of the thyroid gland, should hardly be entertained; this operation is specially dangerous owing to almost uncontrollable hæmorrhage, and the disease does not affect the general health nor peril life. If resorted to, the operation must be performed by an incision in the middle line of the neck, so as to turn the tumour out of its bed, and ligature of the vessels as they are successively divided. Removal of any portion of the gland, as of the isthmus crossing the trachea, should be accomplished with similar precaution; and the remainder of the gland secured on either side by double ligature, previous to excision of the intervening portion.

(2) *Inflammation* of the thyroid is rare; it occurs spontaneously, perhaps, in scrofulous persons only.

(3) *Fibrous, cartilaginous, and osseous* formations, sometimes occur in this gland; *tubercle* is scarcely ever seen, and *cancer* in its medullary form is very exceptional. (Rokitansky).

(4) *Hernia Bronchialis* is occasionally produced by protrusion of the mucous membrane through the cartilages of the larynx or the rings of the trachea, as a result of violent exertions of the voice. Larrey met with it in French officers, and in the priests who, with their deep-toned voice, call the people to prayer from the minarets in Mohammedan countries—as I often heard them do at Scutari.

The tumour is soft and elastic, increased by any expiratory effort, and it often disappears on pressure. The support of a compress is the only curative treatment.

**PAROTID GLAND.—PAROTITIS OR MUMPS.**—An inflammatory swelling of the parotid gland, involving the sub-maxillary and sub-lingual glands; and usually affecting both sides of the neck. Some pain and stiffness accompany this glandular enlargement; but suppuration rarely supervenes, although the swelling may be very persistent. It migrates, occasionally—by metastasis, as it is said—to the testicle, or to the breast in the female. Commonly occurring in children, and sometimes in adults; the disease arises apparently from cold and damp, and has a slightly infectious character.

There is no danger in this affection, only considerable inconvenience.

The *Treatment* consists simply in the topical application of warm fomentation or poultice, and subsequently stimulating embrocations when the swelling has become quite indolent. Saline aperients and tonics form the constitutional treatment. The metastatic affections must be treated as similar inflammatory swellings of the parts attacked.

**TUMOURS.**—(1) *Glandular parotid tumour* is the most frequent tumour in connexion with the parotid gland. It is probably developed in one of the lymphatic glands lying over the parotid, or it may occasionally be developed in the fibrous envelope of the gland itself. It resembles the adenoid or glandular tumours connected with the mammary or prostatic glands, and is described by Bauchet as an hypertrophy of the parotid. It consists of fibrous tissue mixed with glandular elements, in which there are often portions of cartilage, and one or more cysts. A distinct capsule generally encloses and isolates the tumour.

This parotid tumour appears as a firm hard lump, situated generally below and behind the lobe of the ear, but sometimes in front of it. (Fig. 377.) Growing slowly, and displacing the parotid and the parts contained therein, the tumour becomes buried deeply behind the ramus of the jaw. Besides deformity thence arising, hearing and mastication are

interfered with; and perchance facial paralysis may occur on the affected side.

*Treatment.*—Removal of the tumour with a knife is the only cure, but the operation is both difficult and dangerous. A  $\perp$  incision will be most convenient; the vertical line passing down the posterior edge of the tumour,

FIG. 377.



where it is most safely approached. It has been known to recur a second and a third time, as in a case recorded by Langenbeck, at the end of a year, and again after five years the tumour was successfully extirpated.

(2) The parotid region is subject to other tumours, which however are not at all peculiar to this part of the body. Thus, we recognise—*fibro-cellular, fibrous, fatty, cystic, cartilaginous, and cancerous* tumours; as growths incident to the parotid region. (Fig. 378.)

The removal of any such tumour must be determined by its size and apparent connexions; a cancerous tumour being irremovable probably, owing to its infiltrating character.

*Excision of the parotid gland* is an operation scarcely to be entertained in a work on Surgery; the irregular connexions of the parotid, and the important structures passing through it—the external carotid artery and facial nerve, render the extirpation of this

FIG. 378.





gland a surgically-impracticable operation. Portions of the gland may be removed with an overlying tumour.

**TUMOURS OF THE NECK.**—(1) *Enlargement of the cervical glands*, in scrofulous persons, is a common surgical affection; presenting round, puffy or indurated, sub-maxillary lumps; indolent or suppurating. A chain of rather large, rounded tumours, along the anterior margin of the trapezius, on both sides of the neck, is said by Miller to be characteristic of syphilis; and these lumps, though indurated, never suppurate. They are sometimes the first symptom, and the last to go, of any constitutional symptoms. Glandular enlargements of stony hardness, and involving the whole lymphatic chain, may be conjoined with exophthalmic goitre, as a result of the anæmic condition. Such enlargement resembles scirrhus affection, but has a totally distinct origin.

(2) *Induration of the sterno-mastoid muscle*, is not uncommon in children. It may be distinguished from any enlargement of the cervical glands, which lie posterior to the muscle, by two circumstances; in the one case, the swelling is within the sterno-mastoid, and its mobility varies with the contracted and relaxed state of the muscle; in the other case, the swelling is behind the muscle and is unaffected by its action.

This muscular affection is very curable in childhood, by counter-irritant and tonic measures; while glandular enlargements are obstinate and may be quite incurable.

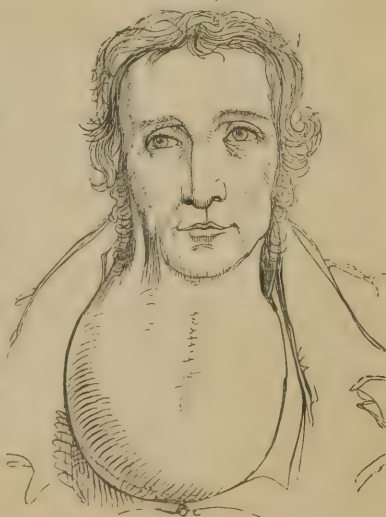
(3) *Enlarged Bursæ* are found in the anterior part of the neck, although rarely. These bursal tumours may be situated in front of the pomum Adami, or between the posterior surface of the hyoid bone and thyroid cartilage, or between the muscles of the tongue. The tumours rise and fall in the movements of deglutition, thus resembling cystic bronchocele; but their situation is partly distinctive, and puncture will determine the diagnosis, by the nature of the contained fluid.

*Treatment* consists in blisters, puncture and injection of iodine.

(4) *Cysts* singly, or aggregated and forming a multilobular tumour,—known as hydrocele of the neck,—may occur in either triangle of the neck, commonly the posterior triangle, or beneath the sterno-mastoid muscle. Such cyst or cysts may be situated superficially, usually more deeply; and sometimes become so numerous as to occupy the whole side of the neck. The contents of the cysts are various; serous, or sanguineous fluid of a brownish colour, or sebaceous matter. (Langenbeck.)

The characters of the tumour thus formed are always similar; a tense and elastic, round or somewhat lobulated swelling; varying in situation, prominence and size. Deglutition and respiration may be more or less impeded. The diagnosis from *abscess* will be determined by puncture.

FIG. 379.



*Treatment.*—Tapping and injection with iodine. Suppurative action by means of a seton may be equally curative, but it is more hazardous. Extirpation will scarcely ever be practicable, owing to the situation of these cysts.

(5) *Fatty* tumour (Liston) (Fig. 379), *fibrous* tumour, *cartilaginous* tumour (Spence), and *cancerous* tumours, are occasionally met with in the neck; *epithelial* cancer, rarely.

The removal of these growths must be guided by general principles, having regard to the situation and connexions of the growth.

## CHAPTER XLVIII.

### INJURIES AND DISEASES OF THE SPINE.

THE Anatomical construction, and the Physiological or functional uses of the several parts, of the Spine or Vertebral column, should be remembered, in relation to its Injuries and Diseases.

*Anatomically*, the Spine—so named from the series of spinous processes presented posteriorly—consists of three elementary portions; the columnar portion, the canal, and the processes, articulatory, and those for the attachment of muscles.

The *functions* or *uses* of the Spine are threefold, and correspond to its anatomical elements. It is, a *column* or pillar for sustaining the weight of the head and trunk, at the same time being a girder to support the ribs, and connect the bones of the extremities; an *elastic-jointed* mechanism for flexible motion; and an *osseous canal* for containing and protecting the delicate, and vitally important structure of the spinal cord. But the integrity of the cord is also secured by three other special provisions. Firstly, by its central position in the vertebral column, the cord occupies neutral ground in relation to the forces which might cause sprain or fracture; in compression of the column forwards, and laceration of the posterior segment, the cord remains centrally, in a neutral state. Secondly, the elastic and graduated flexibility of the column, prevents the effects of shock, and abrupt motion, being communicated to the cord. Thirdly, its loose suspension in the canal, and enclosure in a layer of sub-arachnoid fluid, which acts as a water-cushion, will further resist concussion.

The flexibility of the vertebral column varies in different regions, the cervical, dorsal, and lumbar; being least in the dorsal region, where compared with the length of this portion of the spine, there is a smaller proportion of inter-vertebral substance than in the cervical and lumbar portions of the column. To compensate for these various degrees of flexibility, certain curves are introduced near the respective junctions, to equalize the movements. The *weakest parts* of the column, and consequently the parts most liable to injury, are at the junctions of flexible to comparatively inflexible portions of the column. Hence, these parts are; the dorso-lumbar; the cervico-dorsal; the atlo-axial, regions.

The various kinds of injury and disease including malformation, to which the spine is liable, may be conveniently arranged in order as follow;

(1) Wounds, involving the cord; (2) Sprain; (3) Fracture, and Dislocation; (4) Concussion; (5) Compression; (6) Caries; (7) Lateral Curvature; (8) Spina Bifida.

**INJURIES.**—WOUNDS, like other injuries, of the spine, owe their importance to the probability or certainty, as the case may be, of the cord being involved, primarily by the lesion itself, or secondarily by its inflammatory consequences.

The *causes* of any such wound are; stabs with pointed instruments, as by a sword thrust, or with a knife or fork; gunshot injury; fracture of the spine, implicating the cord, by pressure of a displaced fragment. This latter cause of wound is associated with compression of the cord, and is the most common form of that injury.

Certain *symptoms*—those of paralysis, motor, sensory, or both, are common to a wound of the spinal cord, in any part of its extent; unless above the origin of the phrenic nerve, opposite to or above the third cervical vertebra, when death is instantaneous from paralysis of the diaphragm and other respiratory muscles, causing immediate asphyxia. But the symptoms of paralysis vary according to the *region* in which the cord is wounded,—as in the cervical region, below the origin of the phrenic nerve, the dorsal, or the lumbar regions; and the corresponding symptoms, which indicate these injuries of the spinal cord, are fully described in connexion with Fracture of the Spine.

**SPRAINS.**—The ligaments connecting the vertebræ, together with the muscles which lie in the vertebral groove on either side of the spinous processes, are liable to be overstretched and torn, sprained, or ruptured. Any such lesion will be more or less localized, according to the rigidity of the part injured, as in the dorsal region, or its elasticity, as in the cervical or dorsal regions,—where, the force being broken and distributed, the sprain will be more general.

The *symptoms* are, sudden and acute pain in the part affected, which is elicited by pressure, or by any movement involving that part of the spine. The patient, therefore, lies in the position which ensures rest. Swelling and ecchymosis, may be well marked or scarcely perceptible; and the discoloration may not ensue for some days after the injury. The *diagnosis* from fracture of the spine will be determined by the absence of any displacement in the vertebræ, the line of the spinous processes being straight, and their points level. The pain on pressure is not limited to the processes of one or two vertebræ, as in fracture; and the patient can erect the spine, though with painful difficulty, but without presenting any deformity. The symptoms of sprain continue for a longer or shorter period; a bad sprain in the loins lasting, perhaps, for a month or six weeks. Voluntary movement is gradually attempted as the pain induced passes off, and this will be the surest sign of progressive recovery.

The *causes* of spinal sprain are generally such occasions of violence as bend the column downwards and forwards, with a sudden and excessive depression. The force may be external, as by a heavy weight falling on the back when the lower limbs or the pelvis is fixed; the dorsal spine then acting as a long lever, the junction of its base with the pelvis being the fulcrum, and the superincumbent weight of the trunk representing the force, forwards. The lumbar spine is thus sprained. A similar effect may be produced by the weight of the trunk itself, as when a person falls or jumps from a height, and alights on his nates. The to-and-fro twisting of the spine resulting from a railway collision, may produce the most



severe sprain. Violent muscular efforts may sprain some part of the spine, as in the endeavour to lift a heavy weight, or in pulling; or by a sudden wrench in the act of starting forward from impending danger.

*Complications, and Consequences.*—Sprain in the lumbar region is not unfrequently complicated by *hæmaturia*, blood passing with the urine, for several days after the accident. This arises from some lesion of one or both kidneys, owing to their contiguity to the lumbar spine. The quantity of blood lost varies. Generally, the urine has a deep red or brown colour, only for one or two days; it may become clear and florid on the third or fourth day; and, in a day or two more, the urine may resume its natural appearance. Clots sometimes form in the bladder. Nephritis,—inflammation of the kidney, rarely ensues, as a consequence of this traumatic hæmaturia; an immunity in connexion with injuries of the spine, which is unexceptional in the experience of Mr. Le Gros Clark. Previous disease of the kidneys will predispose to hæmaturia from comparatively slight injury to the lumbar spine; as when associated with renal calculus, or with the congestive, early, stage of albuminuria.

*Hæmorrhage into the vertebral canal*, with compression of the cord, and paralysis, is an occasional complication of spinal sprain. It will always be difficult or impossible to determine by appropriate symptoms, whether the intra-vertebral hæmorrhage be situated outside or inside the theca of the cord, and hence the source of the extravasated blood. Post-mortem examinations of clinically observed cases are wanting, to complete the solution of this interesting question.

*Inflammation of Joints of the Spine.*—A serious consequence of sprain of the spine is inflammation of the articulations; extending perhaps to the membranes of the cord, as spinal meningitis, or even involving the cord, spinal myelitis. Suppuration within the vertebral canal may ensue, and thence compression of the cord. But, the loose connexion of the fibrous theca or dura mater within the canal, which has a distinct periosteum,—unlike the adherent dura mater within the cranium, which serves the purpose of periosteum, is an anatomical condition unfavourable to the extension of the articulatory inflammation of the spine. The violence of the sprain is certainly no measure of the probability of inflammation supervening; comparatively slight injury having perhaps this consequence, while severe sprain may not be followed by inflammation.

The *symptoms* are those of paralysis, the inflammation being of a chronic character and leading to suppuration. In an early stage, the paralysis may be partial, depending on the compression of some of the spinal nerves, as they issue through the inter-vertebral foramina; in a later stage, the paralysis may become more general, from intrusion of the abscess into the vertebral canal, and compression of the cord, resulting in complete paraplegia. At this stage, chronic abscess around and within the vertebral canal, as the consequence of spinal sprain, might be mistaken for caries, with abscess and destruction of the bodies of the vertebræ. But the absence of angular deformity at the seat of disease by the upper portion of the column inclining forward, will probably determine the question of diagnosis. Spinal abscess from sprain may terminate by resolution with the removal of compression, and restoration of the functions of the cord; leaving perhaps the diseased articulations in a state of ankylosis. Or, the abscess breaks, and continuing to discharge pus, the prognosis is unfavourable.

*TREATMENT.*—Uncomplicated sprain of the spine should be treated on

the principles which relate to sprains of the joints generally:—(1) Perfect rest of the body, in the recumbent position, or on a prone couch; (2) Fomentations, warm and sedative, as by a decoction of poppy-heads, or a lotion of lead and opium; subsequently, stimulating applications, as camphor liniment, or the tincture of iodine; (3) Mercurials, as the bi-chloride, in small and continued doses, with bark, and good nourishment. Some sort of stay support may be requisite when the patient begins to get about.

The complications and consequences of spinal sprain must be treated as explained in connexion with Hæmaturia, and Compression of the spinal cord from intra-vertebral hæmorrhage or suppuration.

**FRACTURES OF THE SPINE.**—*Structural Conditions.*—The several parts of each vertebra are liable to fracture. The processes, articular, transverse, and spinous, may severally be the seat of fracture; and in particular, the spinous process. The arch is sometimes fractured on either side of this process; and the body of the vertebra is liable to fracture obliquely. The ligaments corresponding to these several portions of bone are ruptured with fracture, more or less completely. In fracture of the body, the anterior and posterior common longitudinal ligaments are torn through. Displacement will depend on the extent of fracture, and on whether the force producing it be direct or indirect. Thus, fracture of the body of a vertebra, and by indirect violence, as a fall on the head from a height, will occasion great displacement; the upper portion of the body being driven downward and inwards, and the lower backwards and upwards, with excurvation of the spine posteriorly. (Fig. 380.) Direct violence of an extreme kind will also produce displacement; as a gunshot injury to the spine.

FIG. 380.



*Dislocation* may accompany spinal fracture; and dislocation of the articular processes in the back and loins cannot, perhaps, occur without fracture. In the neck, these two forms of injury may occur independently. This difference is owing to the different direction of these processes in the three regions of the spine; in the cervical region being oblique and approaching a horizontal direction; while in the dorsal and lumbar regions, they are vertical.

The spinal cord and its membranes suffer compression or laceration, in fracture with displacement of the bodies of the vertebræ (see Fig. 380); but the membranes are comparatively rarely ruptured or torn.

Arterial hæmorrhage in the substance of the cord is inconsiderable; the vessels permeating the cord being minute and soon ceasing to bleed. Venous blood, from the large sinuses in the vertebral canal, collects in perhaps considerable quantity between the vertebræ and the dura mater; and particularly under the arches of the vertebræ where the attachment of this membrane is loosest.

*Symptoms.*—The symptoms of spinal fracture are both general and special or pertaining to the particular region which may be the seat of fracture.

The *general* symptoms are locally some alteration of contour in the line of the spinous processes, depending on and proportionate to the *displacement*. The processes above the seat of fracture are depressed, and correspondingly prominent below. The transverse processes also may have become prominent, and the spine twisted on itself. Rarely can any mobility or crepitation be felt, unless the fracture be limited to one or other of these processes. Pain is experienced at the seat of injury, and there is a notable inability to support the trunk erect. The general symptoms otherwise refer to injury of the *spinal cord*, itself also dependent on the displacement. The functions of the cord are more or less completely suspended or destroyed. Thence, paralysis of sensation and voluntary motion below the seat of fracture; involuntary evacuation of the *fæces*, which become blackish, pultaceous, and have an offensive odour, and retention of urine, which becomes ammoniacal, and voided by a dribbling incontinence. Such are the regular symptoms. Priapism and emission of the semen may occur as occasional symptoms.

Fracture in the upper part of the *lumbar* region, produces also a tympanitic condition of the abdomen; the intestines being almost suddenly distended with gas. In the upper part of the *dorsal* region, the thoracic respiration is embarrassed or suppressed, by compression of the cord above the origins of the intercostal nerves. At the *sixth cervical* vertebra fracture is attended with paralysis of the upper extremities; and above the *third cervical* vertebra, compression of the cord will be instantly fatal by asphyxia—the phrenic nerves thus being paralysed.

*Causes.*—External violence applied directly, or indirectly, to the vertebral column, represents the two modes of fracture-production. A blow or fall, on the back, is one mode of fracture; a fall on the top of the head, or compression of the trunk vertically, as between the box of a carriage and an archway, is the other, or indirect mode of producing fracture of the spine.

Extravasation of venous blood in the vertebral canal, between the vertebræ and dura mater membrane, has already been noticed; but its pathological operation is significant, as being an additional source of any pressure on the cord arising from displacement *with* the fracture.

*Course and Termination.*—Inflammation with effusion, may be a further occasion of pressure, at a subsequent period. Bed-sores are extremely liable to form over the sacrum or other prominent points, when subject only to the pressure of a water-bed; the vitality of the skin declining in consequence of the paralytic condition. A chronic inflammatory state of the bladder, with mucous or muco-purulent, and ammoniacal urine, supervenes; and even sloughing of the bladder, with extravasation of urine, I have known to occur. Increasing exhaustion accompanies the paralysis, and death ensues.

But the *period* of fatal termination which thus takes place in most cases, varies according to the situation of fracture, the degree of displacement also, and pressure on the cord. Above the third cervical vertebra, death may not occur immediately, unless the fracture be attended with displacement. Between the fourth cervical and the first dorsal, fracture is not generally fatal, under from three to ten days. With fracture in the dorsal region, the patient may live from two to three weeks. With fracture in the lumbar region, life may be prolonged from three weeks to two months, or possibly, many months.

*Treatment.*—The fracture itself cannot be treated. No displacement



of consequence, can well or safely be rectified; and no mechanical appliances can be applied effectually. Any injury to the spinal cord must be treated with reference to inflammation. The patient being placed in bed, flat on his back, to ensure rest; local depletion by leeches may first be employed, followed by counter-irritation, cautiously, having regard to the tendency to bed-sores. Subsequently, the administration of strychnine in small and increasing doses, continued until slight tetanic twitchings are produced, will have the most beneficial influence on the paralysis. *Trephining* the spine, was proposed by Mr. Henry Cline, and actually performed by him in one case, and by Mr. Tyrrell in another. Both were fatal. And this practice is properly condemned by Liston and Lawrence.

The state of the bladder will require the constant introduction of a catheter to relieve retention; while the treatment appropriate for chronic cystitis may have some avail in changing the character of the urine. Bed-sores must be prevented, if possible; or treated, by a proper adjustment of ring-cushions or air-pillows, and a water-bed is often a critically important resource.

CONCUSSION OF THE SPINAL CORD.—This expression is used to denote a shock, shake, or jar, of the spinal cord, as the immediate effect of violence, directly or indirectly applied to the Spine. This is attended with or followed by an impairment or loss of functions depending on the integrity of the cord—symptoms of a paralytic character.

The *pathology* of injury referable to concussion of the spinal cord, has been, and is still, disputed. It is argued, that the peculiar anatomical construction of the spine, and the condition of the enclosed cord—the elastic and graduated flexibility of the one, and the loose, isolated state of the other, suspended in a tubular investment of sub-arachnoid fluid; are circumstances which render it highly improbable, if not impossible, that vibrations of force should be communicated to the cord. All these circumstances are of an opposite character in relation to the brain, which is subject to concussion from injury to the head. On the other hand, injury of the spine, accompanied with paralytic symptoms, is not unfrequently met with; in which, upon examination during life, or after death, no fracture, displacement, extravasation of blood, or other cause of compression, can be discovered. Injury of this kind, distinguished by the absence of any perceptible structural alteration, is referred to concussion of the cord, in explanation of the peculiar functional symptoms. And analogy would seem to confirm this interpretation of the symptoms produced, although the intimate nature of the change in the concussed or shaken nervous structure cannot be demonstrated. We do not know—observes Mr. Erichsen—how it is that when a magnet is struck a heavy blow with a hammer, the magnetic force is jarred, shaken, or concussed out of the horse-shoe. But we know that it is so, and that the iron has lost its magnetic power. So, if the spine is badly jarred, shaken, or concussed by a blow or shock of any kind communicated to the body, we find that the nervous force is to a certain extent shaken out of the man, and that he has in some way lost nervous power.

The *secondary* changes of structure which the spinal cord undergoes are those of inflammation, of a chronic character; and as affecting the membranes—chronic Spinal meningitis, and the cord—chronic Spinal myelitis; the former usually extending to, or being accompanied with a similar affection of the cerebral meninges—chronic Cerebral meningitis.

In *Spinal Meningitis*, the structural changes consist ; of increased vascularity of the membranes, the meningo-rachidian veins being engorged, and the vessels of the pia-mater injected, in patches or uniformly ; serous fluid, reddish and clear, or opaque from the admixture of lymph, is effused, more or less in quantity, within the arachnoid, or there may be adhesion of its visceral and parietal surfaces, and puriform lymph in the sub-arachnoid space. In *Spinal Myelitis*—the inflammation affecting the substance of the cord, this undergoes softening, and atrophy—the whole of the nervous substance even disappearing, and leaving nothing but connective tissue at the part affected. The extent of this structural change varies ; the whole thickness of the cord may be affected at one point, or one of the lateral halves in a vertical direction, or it may be limited to the anterior or posterior aspect ; or restricted principally to the central gray portion, rather than the circumferential part of the cord. When myelitis is consecutive to meningitis, the inflammatory softening may—according to Ollivier's observations—be limited to the white substance. Such change of structure may have taken place in one region only ; in the lumbar portion of the cord, most frequently ; in the cervical, next in order of frequency ; in the dorsal, less commonly. The whole length of the cord is very rarely affected. Induration, with hypertrophy, of the nervous-substance of the cord—which resembles boiled white of egg, instead of softening and atrophy, may be the result of chronic myelitis ; as in the case of Count de Lordat, and similar cases are related by Portal, Ollivier, and Abercrombie.

Spinal Meningitis and Myelitis occasionally exist separately, either without the other ; more commonly they co-exist, but associated in very different degrees.

As the result of *railway collision*, only one case of post-mortem examination is recorded, where death ensued from the secondary and remote effects of Concussion of the spinal cord ; and whereby the symptoms observed during life were shown to be dependent on the pathological changes of structure, which, in the history of this one completed case, are presumed to exist in other similar cases. The patient was under the care of Mr. Gore, of Bath, who, however, did not see him until about a year after the accident, and then at intervals up to the time of death. The cord was carefully examined by Dr. Lockhart Clarke ; and the case is referred to by Mr. Erichsen in his "Railway Injuries," Mr. Le Gros Clark in his Lectures at the College of Surgeons, and by Mr. Shaw, in Holmes's Surgery. The case was that of a man, middle-aged, of active business habits ; who having been in a railway collision, and, without any sign of external injury—wound, bruise, fracture or dislocation, began to manifest the usual nervous symptoms. He gradually, but very slowly, became partially paralysed in the lower extremities, and died three years and a half after the accident. Post-mortem examination of the spinal cord disclosed the inflammatory congestion of the meninges, effusion, softening and atrophy, already described. More recently, a minute examination of the structural changes consequent on concussion of the cord, was made by Dr. H. Charlton Bastion. A man fell from the top of a hayrick, and had partial paraplegia, motory, but not sensory. He lived six months. Post-mortem examination showed that the medulla oblongata and spinal cord had undergone extensive granular degeneration. The important practical fact was, that in conjunction with such disorganization, the patient gradually recovered some power of voluntary motion in his limbs, and that

sensation remained unimpaired to the last. This case is reported in the *Med.-Chir. Trans.*, vol. 1.

*Symptoms.*—Concussion of the Spinal cord is attended with, or followed by, symptoms of a paralytic character, which are essentially the same in all cases; but which vary in degree, according to the direct or indirect force of the concussion, and still more in proportion to the severity or comparatively slight intensity of the injury.

(a) *Direct and severe* concussion is attended with immediate and marked symptoms. Pain at the seat of injury is felt, with loss of power in the extremities below that part, and there may be relaxation of the sphincters, the fæces and urine perhaps escaping involuntarily; and all these symptoms being accompanied with those of general Shock to the nervous system. The symptoms may pass off in the course of a few days, or result in complete paraplegia, of some months' duration or permanently irrecoverable.

(b) *Direct, but slight* concussion, is followed by similar symptoms, developed slowly and insidiously, in the course of several weeks or months; so that the causative relation between that comparatively slight injury and these apparently independent and serious symptoms subsequently, may seem improbable to the patient and to those who are unacquainted with such cases, and may be overlooked by the Surgeon. The symptoms referred to, and the order of their development, will be more particularly described in connexion with the next mode of spinal concussion.

(c) *Indirect concussion, from a general Shock to the nervous system* or of the whole body.—Railway collision usually causes this mode of concussion; the carriage being brought suddenly to a stop, the traveller's body is carried forward by its own momentum, and dashed forwards against the opposite side of the carriage, thence perhaps to rebound back again. Or, without any contact from collision, the body may receive the shock, and the trunk be thrown backwards and forwards with a considerable concussion, thus also wrenching and twisting the spine to and fro in the nature of a sprain. A fall or jump from a height, the individual alighting on his feet, or his nates, may have a similar effect; general concussion involving the cord, and spinal sprain.

The *symptoms* arising from this mode of concussion, are often slow and insidious in their progress, weeks or months elapsing ere they assume a marked intensity. They relate to the brain, the spinal cord, and the limbs.

Immediately after a railway collision an individual may suffer no apparent injury, beyond feeling generally shaken, and somewhat faint or confused: and this disturbance may soon pass off, leaving the person himself again, able to assist his seemingly less fortunate fellow-travellers, and having thus occupied himself for some hours, he proceeds on his journey. From that time, however, a general failure of nervous power ensues, the sufferer feels that the spring and the go has been taken out of him, bodily and mentally; he looks pallid, dejected and older, broken in general health—a change which is more obvious in a person of previously active habits. His friends remark, and he feels, that “he is not the man he was.” Trying, perhaps, from time to time, to resume his avocations, he is compelled to lay by, and with rest, getting better, he tries again, only to fail, until he is at length fairly knocked up. But some weeks or even months may elapse before more definite symptoms become developed. They correspond, it may be presumed, with the second stage; that wherein



the primary effects of general concussion are succeeded by the symptoms of chronic inflammation of the membranes, and of the substance of the spinal cord, with similar affection of the brain. Mr. Erichsen has carefully analyzed the symptoms presented, of which the following is a summary; premising that while all the symptoms may be manifested in the same case, they are not necessarily associated.

*Cerebral symptoms.*—With a pallid, careworn *expression*, usually presented; *pain*, giddiness, or some uneasy sensation in the head, is complained of, or may be elicited by pressure on the crown, and rotation of the head or movement backwards and forwards. The functions of the brain are defective or perverted. The *memory* is deficient as with regard to dates, words, figures. The *thoughts* are confused, the patient being unable to combine his thoughts in argument or reading, so that the latter effort is abandoned after a few minutes' attempt to read a book or paper. As a consequence of this impairment of memory, and inability to concentrate ideas, all business aptitude is lost. The *temper* undergoes some change for the worse, a calm and cheerful disposition often becoming peevish and desponding. *Sleep* is exchanged for wakefulness, or disturbed by horrible and startling dreams. The *special senses* are variously impaired or perverted. *Vision* is defective, in regard to focal distance, and clearness, so that letters of print or writing run into each other. Double vision and squint, are occasionally met with. Intolerance of light is often complained of; and black spots, or flashes of light, are constantly seen. One or both eyes may be affected. *Hearing* may be over sensitive or dull; in the former state any sudden noise startles and distresses the patient. *Taste* and *smell* are more rarely affected or perverted. *Speech* also generally remains unaffected; but stammering or mumbling occurs in some cases. *Touch* is often impaired, the patient being unable to pick up a pin, or button his dress; and the sense of weight is lost, a shilling or a sovereign on the point of the finger feeling of equal weight.

*Spinal symptoms.*—The *attitude* referable to the state of the spine is peculiarly erect and stiff, in consequence of the pain occasioned by flexion forwards, backwards, or sideways, or by any attempt to rotate the trunk. This pain restrains any movement involving the spine, as stooping, or rising from the recumbent position. The pain is elicited on examination of the spine, by pressure or percussion, in the course of the spinous processes, or by application of a hot sponge. At some one, two, or three points, sensibility will be found increased. These are commonly the mid-dorsal, the dorso-lumbar, and the cervical regions, extending over two or three vertebræ. Sometimes the pain extends laterally, on either side of the spine, apparently corresponding to the posterior branches of the spinal nerves. Thence the pain is musculo-cutaneous, as well as deep-seated in the spine. A distressing sensation, as if a tight cord were round the waist, with hiccuppy breathing, is sometimes experienced.

*The Limbs.*—The *gait* of the patient is very characteristic; a straddling, shambling, and tottering walk, as if his legs were not his own. Exercise, therefore, becomes more and more limited; and movement up and down stairs difficult, especially the latter act. A stick is often had recourse to habitually, or the patient steadies himself by laying hold of any support in his way. This loose gait, and rigid spinal attitude, the patient, with head erect, looking straight forwards, presents the appearance of a man walking blindfolded. The *failure of nervous power* in the limbs is very variable in its extent and degree. It may affect one or both

legs, or the arm and leg on the same side, or one arm and both legs, or all four limbs may be more or less paralysed. Motor power only, or sensation only, or both, may be lost, and in an equal or different degrees. Paralysis is seldom complete. Partial paralysis is met with; as in the extensor of the great toe, the flexors of the fingers, or the muscles of the ball of the thumb. Motor paralysis may be tested by the galvanic current, so as to excite the irritability of the same muscles in the opposite limbs. Loss of motor power in the hand can be estimated by the force of the patient's grasp, or more delicately by the dynamometer. The sphincters are rarely affected; frequent micturition being met with occasionally, retention of urine seldom, and involuntary defæcation perhaps never. Diminution or perversion of sensation; comprises numbness, as shown by Brown-Séquard's instrument; coldness, perceptible to the touch, or shown by the thermometer; and various sensations of tingling, like pins and needles, burning and darting sensations. These feelings are often limited to a single nerve, as the ulnar or the musculo-spiral. Sexual desire and power are generally greatly impaired, or even entirely lost.

*Nutrition* fails, the muscles becoming wasted, and soft in some cases, with a diminution in the size of the limbs as shown by measurement; but a contracted and rigid state of certain muscles supervenes in some advanced cases, as affecting the deltoid, the little and ring fingers, the muscles of the calf, or the extensors of the great toe,—these muscular affections contrasting with the softened state of the muscles in general. The *pulse* varies in its character at different periods. At an early period it is usually slow; at a later and advanced period, it is quick, rising to 90 or 100. It is always feeble. This state of the pulse, especially its increased and increasing rapidity, is always a significant symptom.

*Diagnosis.*—Concussion of the spinal cord must be distinguished from other injuries and diseases. From *spinal sprain*, concussion differs in the presence of paralytic symptoms; unless the sprain be complicated by intra-vertebral hæmorrhage, or intra-vertebral suppuration as a consequence of inflammation, in either case causing compression of the cord. *Cerebral Concussion* is difficult to distinguish from concussion of the cord, the two being usually associated; and the precise diagnosis is unimportant. But the pain in parts of the spine, and its rigidity, are differential symptoms as to the seat of injury. From *rheumatism*, concussion of the cord differs in the presence of true paralytic symptoms, motor, sensory or both, and the localized spinal pain; the progressive character of the symptoms, and the previous history of the case, as commencing from injury. The concomitant articular inflammation, and state of the urine, in regard to lithic acid and the deposit of lithates, are, on the other hand, symptomatic of rheumatism. *Hysteria* as manifested through the spinal cord by hysterical paralysis, may simulate paralysis arising from concussion of the cord. But the history of the case, its progressive character also, and without any complete intermission of the symptoms, are clearly diagnostic; while, the sex, age, and temperament, of the patient, with the absence of other hysterical symptoms, may further contrast with hysteria; which commonly occurs in females rather than males, in the young rather than in the middle-aged and old, in those of an excitable and emotional disposition rather than in the steady-going, working man of business, and in whom there are no other symptoms of hysterical affection.

*Terminations, and Prognosis.*—*Death* ensues from concussion of the spinal

cord, in *most* cases, the issue of which has been known. The *period* of the fatal result,—or the probable duration of life,—varies according to the severity of the injury. *Severe* and *direct* concussion of the cord, as from a heavy blow on the back, will probably have a speedily fatal termination; and the more so if accompanied with intra-vertebral hæmorrhage. *Indirect*, and perhaps severe concussion, as from Railway collision, in most cases, which is commonly followed by paralytic symptoms slowly and progressively developed, terminates fatally in a period varying from two and a half to five years; or perhaps at a much later period,—fifteen or twenty years. When death does not ensue, *recovery* may take place, more or less completely, according to the stage of the case after concussion of the cord. The primary, and almost immediate, paralytic symptoms may pass off, and the more probably in proportion to their immediate severity, especially if the patient be young and healthy; recovery taking place completely and permanently. A period of six months, under treatment, will probably suffice to entirely reinstate the health. The *secondary*, and subsequent paralysis, from softening of the cord, consequent on Meningo-myelitis, may result in partial recovery; but complete restoration from this structural change is impossible.

The *Prognosis* of concussion of the spinal cord, must be regulated by the foregoing considerations.

I have entered more fully into the nature of this injury of the cord, on account of its great practical importance, and as being a subject of frequent Medico-legal inquiry; in not a few cases of which I have been engaged.

*Treatment*.—Rest, absolute rest, is essential to any probability of recovery of spinal concussion, or wrench. The patient should keep the recumbent position, or a prone couch may be used, until the paralytic symptoms have disappeared; and especially until the limbs have regained the power of voluntary motion, and sensibility. A prone couch offers the advantages of preventing venous congestion, affecting the spine, as the result of long-continued recumbency; any tendency to sloughing from pressure over the sacrum and nates, the liability to which is always greater in paraplegia, will also be prevented; and the prone position readily allows of any local treatment. Rest of the brain is equally essential to recovery; freedom from the excitement of business or pleasure, which although apparently beneficial for a time, is permanently conducive to a fatal issue. *Local* treatment consists, in derivation from the spinal cord, by means of dry-cupping along the spine on either side; followed by counter-irritation, by blisters, setons, issues, or even by the actual cautery, in the form of the moxa. *Constitutional* treatment comprises, the continued administration of gentle mercurials, especially the bichloride, or iodide of potassium, with quinine, as a tonic. Subsequently, when all inflammatory action has subsided, and paralysis of motion, sensation, or both, alone remains, with a cachectic state of the health; strychnine and iron, will prove efficacious. A sixteenth or twelfth of a grain of strychnine, with three or four grains of the sulphate or phosphate of iron, in the form of a pill, three times a day; may be continued with advantage until slight tetanic twitchings are induced. In conjunction with strychnine, the galvanic current should be employed; one pole of the battery being placed in the course of the spine, while the other is applied up and down the paralytic limbs, so as to excite the action of different sets of muscles. Salt-water douches, and frictions, may also have some beneficial influence. The general health and strength must be supported and renovated by a



nourishing diet, and other hygienic measures. I have seen the best remedial results from this course of treatment, in many cases.

COMPRESSION OF THE SPINAL CORD.—This injury to the cord may depend on either of three causes, or perhaps their concurrent action; intra-vertebral hæmorrhage; intra-vertebral suppuration or abscess; and fracture of the spine, with displacement. The two former causes of compression, must severally be treated on general principles; the latter is noticed under fracture of the spine. Obviously, however, no source of compression affecting the spinal cord, can be readily amenable to treatment.

DISEASE OF THE SPINE.—*Structural Conditions*.—The generic term, disease of the spine, as ordinarily understood, signifies *caries* of the vertebræ, apparently of a scrofulous character; commencing probably in the *bodies* of these bones and involving the inter-vertebral fibro-cartilages. This disease is situated, usually, in the bodies of the *mid-dorsal* vertebræ; but extending upwards and downwards to several vertebræ, the upper or lower dorsal, or even the upper lumbar vertebræ and fibro-cartilages, may be diseased. The bodies of the affected vertebræ becoming disintegrated, and the cartilages destroyed, the spine yields under the superincumbent weight of the trunk, and gradually bending forwards forms an “angular curvature,” commonly known as “hump-back;” presenting a prominence of the spinous processes of the vertebræ posteriorly at the seat of curvature.

The *spinal column* occupying the middle line of the body and being equally balanced laterally, it bends forward in that line without lateral deviation. Some such inclination is apt to take place, to one side or the other, only in the dorso-lumbar and lumbar regions, where the spine has the greatest latitude of motion. At first also, the degree of angular deformity backwards and forwards, corresponds to and represents the amount of destruction of the bodies of the vertebræ. But the human figure—unlike the permanent direction of an inclining column of brick-work, or other dead weight, yielding in the middle—has some compensatory power of gradually restoring itself to the perpendicular; thereby correcting any irregularity in the line of gravity. The spinal column is, in fact, a flexible pillar of support, and subject to the action of muscles. Accordingly, as Mr. Shaw observes—a person with angular curvature of recent occurrence and tending, therefore, to tumble head foremost—gradually regains the line of gravity. Habitually throwing the head and shoulders backward, he walks with an apparent air of pride; the angular excurvation ultimately becomes combined with two incurvations, one above, and the other below, in contrary directions; the whole spine assuming an appearance, in profile, not unlike a double bracket ( { ). If angular curvature takes place at the very base of the spinal column, allowing the whole trunk to incline forward, any such restoration of equilibrium will be impossible; and the patient gropes along with the body horizontal to the legs. The *thorax* falling down, with the spine above the point of curvature, becomes shut up as it were; the ribs being compressed, and the sternum projecting, or sometimes bent at an obtuse angle as a sort of counterpoise to the posterior protuberance. The shape of the thorax is altered, its antero-posterior diameter being increased and the vertical decreased. This shortening of the trunk gives a pot-bellied appearance to the abdomen; the whole trunk seeming to have fallen down in a lump. The viscera, thoracic and abdominal, also undergo compression; but accommodating themselves to their respective

cavities, they do not suffer apparently in their structure or functions. The aorta still following the course of the spine, bends with it at the seat of curvature. Rarely is the spinal cord compressed or otherwise injured; sometimes, it becomes softened at the angle of curvature and paralysis of the parts supplied below ensues.

*Signs and Symptoms; and Diagnosis.*—Disease of the spine commences with a sense of weakness in the back, the patient feels some inability to stand upright, and leaning forwards, rests his hands on his knees, or avails himself of any other temporary support. This sign is never absent, and it is rendered equivocal only by its connexion also with hysteria affecting the spine. A slight *prominence* soon appears in some portion of the spine, usually in the dorsal region, and this point is tender or painful when pressed or tapped with the fingers; the patient wincing when pressure falls on it in examining the line of the spinal column. But pain is a very inexact symptom. It may be entirely absent with marked angular deformity, and present, severely and persistently, in a particular spot without spinal disease, as in some cases of hysteria. *Rigidity* of the spine is an equally early and exact sign with falling weakness and angular deformity. It is readily perceived by desiring the patient to stoop and raise himself alternately, or by then placing the hand on the suspected vertebræ; the spinous processes may be seen and felt to move unitedly as a connected mass. This loss of separate mobility is said to arise from the adhesive solidification around the arches of the vertebræ, forming a compensatory support, while the bodies are destroyed by carious disintegration. Symptoms referable to the *spinal cord* supervene; shooting pains extend round the trunk or down the limbs; and the patient has a tottering, sprawling gait, with spasmodic affections of the muscles of the lower extremities, or relaxation of the sphincter ani and retention of urine, or other paralytic symptoms. The angular deformity of the spine has now become well marked, and is rendered more conspicuous by wasting of the muscles in the trough on either side of the spinal column. The excurved ridge of ~~transverse~~ processes stands out like a keel, with a serrated edge, the tubercle of each process being distinctly visible. The transverse and oblique processes, also, become distinguishable.

Pus forms in connexion with caries of the vertebræ; at a more or less early period, and more or less abundantly, in proportion to the tuberculous character of the disease. The pain and paralytic symptoms—referable to the spinal cord, are relieved for a while, by suppuration. But it is only as a presenting abscess, that the formation of matter becomes clearly available as a symptom of disease of the spine. This event—the appearance of an abscess, will depend on the progress of spinal disease, as described in connexion with its *course*.

*Causes.*—The scrofulous constitution is probably always predominantly influential as a predisposing cause, leading to a deposit of tuberculous matter in the bodies of the vertebræ, which seems to be the exciting cause of carious disintegration. Some slight injury to the spine may apparently give rise to the disease,—fixing the date to which it would appear referable.

Any period of life is liable to caries of the spine. Beyond middle life it is very rare; in childhood and adolescence, most common. It occurs equally in both sexes.

*Course and Terminations.*—*Abscess* results from the continued forma-

tion of matter. It may undergo *resolution*, the matter being slowly absorbed. In this way a large proportion of patients pass through the whole course of spinal disease, even to paraplegia, and regain their general health, without any signs of abscess in connexion with the vertebræ having appeared. A process of restoration goes on also in the vertebræ. Carious disintegration and absorption are followed by bony deposit between the bodies,—in the place of inter-vertebral fibro-cartilages, thus fusing and consolidating the bones into one mass; while bridges of bone are thrown out from body to body, forming additional buttresses of support to the spinal column. This *anchylosis* is the natural cure of disease of the spine,—a not uncommon event, especially when aided by proper treatment; the patient remaining deformed.

In a case of angular curvature, at the junction of the last dorsal and upper lumbar vertebræ, and of two years and a half duration from the symptom of falling weakness; I succeeded in inducing anchylosis by the recumbent position continued for nine weeks, when the patient had sufficiently recovered to take gentle walking exercise. After the lapse of nine months, he could walk ten miles a day, and had recently become a Hansom cab-driver,—bearing the pull of the reins without any return of the spinal disease.

*Presenting* abscess represents the unfavourable course of spinal disease, as implying the continued formation of matter and destruction of the spinal column. An abscess thence proceeding, presents or makes its appearance in a variable *period*;—early, with weakness of the spine and before any deformity; or at a later period, after months or perhaps years. It appears in various *situations*; according to which, abscesses connected with spinal disease are nominally distinguished, irrespective of the particular parts of the column whence they arise. The route of any such abscess, “by translation,” is often very devious and extensive.

*Psoas abscess* is the most common, and typical. The matter arising from the dorsal or lumbar vertebræ, enters the sheath and substance of the psoas muscle,—passing in the former case through the diaphragm near the ligamentum arcuatum. Following the line of the muscle, the matter descends obliquely outwards, and passing under Poupart's ligament, appears in the groin; where by extending upon the thigh it may burrow to the knee, as a large and increasing femoral abscess. A *double* psoas abscess forms occasionally; the collection of matter at the spine, bifurcating, and passing down within the sheaths of both psoas muscles, emerges in the thighs simultaneously.

The *symptoms* of psoas abscess, as regards its connexion with disease of the spine, are somewhat equivocal. The presence of an abscess may be detected in the groin, or even in the iliac region, by the usual symptoms;—a fluid and fluctuating swelling, which is partially emptied of its contents when the patient lies in the recumbent position, and which yields a fluctuation to and fro on careful palpation with one hand placed over the iliac fossa and the other over the swelling in the groin. The communicating channel—under Poupart's ligament—may contract, whereby the abscess in the thigh becomes circumscribed and isolated; as if it were a distinct chronic abscess, connected with diseased femur, instead of proceeding from the spine.

*Diagnosis.*—The *origin* of abscess in the groin is various. It may proceed:—(1) from bubo or glandular abscess; (2) from disease of the hip-joint; (3) from iliac abscess, connected with disease of the iliac bone,



or forming in the fossa; (4) from peri-cæcal abscess, on the right side only; (5) from peri-nephritic abscess; (6) from empyema, perforating the pleura and descending behind the diaphragm. The diagnosis of *abscess*, thus agreeing in situation, but differing widely in origin, will be guided by the *association of other symptoms*; the presence of other symptoms of spinal disease, or those of one of the diseases above named. Thus, with weakness and slight excurvation of the spine, abscess in the groin would indicate this disease; with the present or past association of a chancre, or of shortening of the limb on the side affected; such abscess would, respectively, denote its syphilitic origin, or refer probably to disease of the hip-joint. Compared with other tumours, in the groin or iliac fossa; abscess, in these situations, differs more or less, in its *own* characters. Thus, from *fatty tumour* in the groin, abscess differs, in its fluid and fluctuating character and partial subsidence in the recumbent position, as compared with the solid doughy consistence and irreducibility of a fatty mass. *Femoral hernia* is distinguished chiefly by the perceptible impulse on coughing, and gurgling character of the swelling.

The *progress* of psoas abscess is mostly unfavourable. Resolution of an internal abscess which has already enlarged so far as to become apparent, is a rare event. Slowly perhaps, but surely increasing, the abscess eventually bursts. The general health inevitably undergoes a great change. From a comparatively local state of disease,—the patient carrying about a large indolent abscess in his thigh, constitutional disturbance now supervenes, in perhaps a day or two, or a week or two. Hectic fever with great emaciation supervenes, large bed-sores form, and the patient dies exhausted.

**OTHER VARIETIES OF SPINAL ABSCESS.**—The different *situations* in which spinal abscess may make its *appearance* are specially worthy of notice

Psoas abscess emerges from under Poupart's ligament, in the narrow interval between the united bellies of the psoas and iliacus muscles and the anterior inferior spinous process of the ilium; its progress is arrested by the origin of the sartorius and tensor vaginæ femoris muscles, which incline it inwards obliquely across the thigh, in the line of the sartorius. But the abscess may turn abruptly inward or outward, at the groin; or coursing downwards, divide into two portions, an inner and an outer; or burrow under the muscles of the thigh, into the popliteal space, or pass thence on to the calf or ankle. Sometimes, this abscess descends into the sub-peritoneal tissue of the pelvis, and presents along the rectum at the anus, or emerges from the sciatic notch and passes down by the side of the trochanter.

*Lumbar abscess* is perhaps the next in order of frequency after psoas abscess. The matter passes directly backwards, chiefly by perforating the quadratus lumborum muscle, and presents a rounded broad flattened abscess. Its boundaries usually are; the lowest rib above, the crest of the ilium below, the sacro-lumbalis internally, and the margin of the external abdominal oblique muscle externally. This abscess frequently co-exists with psoas abscess. The matter may come from the lumbar or dorsal vertebræ, having descended from the latter.

*Dorsal abscess* sometimes forms, by the passage of matter directly backwards. Or, matter proceeding from the dorsal vertebræ, passes down under the pillars of the diaphragm along the aorta and iliac vessels, into the iliac fossa, and presents through the anterior wall of the abdomen

above Poupart's ligament; or sinking into the pelvis, it escapes through the sacro-sciatic notch, and collects in the *gluteal* region.

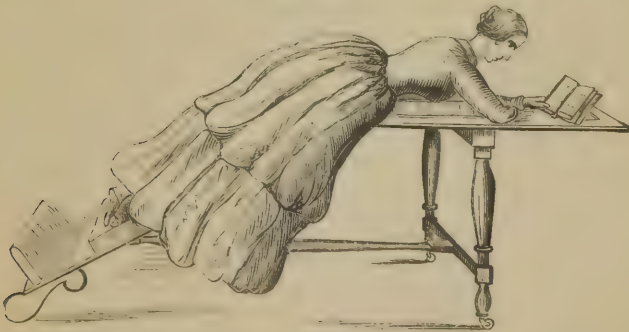
Disease of the cervical vertebræ, exhibits equally remarkable varieties of abscess in respect to the situations of its appearance. The matter coming forwards, it presents behind the *pharynx*, or may descend under the sterno-mastoid muscle to the side of the *neck*; occasionally, it passes down into the thorax, or into the *axilla*.

The pathology of all these varieties of abscess connected with spinal disease is essentially the same as that of psoas abscess. Any such abscess is liable to attain a considerable, even an enormous, size; it bursts, and discharges at intervals or continuously; hectic, or a typhoid type of fever supervening, and a fatal termination.

PROGNOSIS.—The *prognosis* in caries of the spine, is always precarious. A favourable prognosis has reference only to ankylosis, the patient remaining hump-backed for life. But this angular deformity and ankylosis have a concurrent relation; the remnant bodies of the vertebræ becoming united by the falling down of the column. Angular deformity, therefore, usually indicates a more satisfactory result, life being preserved; whereas, the spine remaining straight, is ominous of a fatal issue. For then, the spinal cord, is exposed; paralytic symptoms become aggravated, and abscess increasing by continued caries of the vertebræ, at length bursts, and leads almost inevitably to the overwhelming constitutional disturbance already noticed, hectic and exhaustion.

TREATMENT.—Guided by the natural mode of cure,—ankylosis, the primary indication of treatment is to bring about this result. Hence, absolute rest in the horizontal position must be observed, in order to prevent any motion affecting the vertebræ and to relieve the weight of the trunk from the spinal column. A prone couch (Fig. 381), the patient

FIG. 381.



lying on her belly, answers this purpose best. It should be constructed so as to admit of being raised to a varying angle with the floor, and thus render the position more tolerable than an absolutely horizontal posture. The prone position of the patient is preferable to the recumbent, as the angular prominence of the spine escapes compression and any tendency to congestion affecting the diseased vertebræ; both of which evils would result from a long continued resting of the patient on his back. In this way the progress of the disease may be arrested without further measures. Blisters, setons, moxæ, are sometimes useful adjuncts, as means of counter-

irritation; but they more commonly prove obnoxious by disturbing sleep, and enfeebling by giving rise to a draining discharge. Should these appliances be resorted to, the prone position will, obviously, be more convenient; as well as being otherwise advisable. This plan of treatment

FIG. 382.



having been pursued for six months, a year, or more, according to the state of the disease; some degree of freedom may be allowed to the patient by wearing an apparatus to support the trunk.

It consists of a broad pelvic band, as the basis, from which two steel rods, one on either side of the trunk, pass upwards, terminating in padded crutches for the arm-pits. A back plate is added for the direct support of the spine at the seat of curvature. (Fig. 382.)

Throughout the whole course of the disease, medical treatment should have regard to the improvement of nutrition. Hence tonics, of which iron and quinine are most efficacious, with cod-liver oil, and a generally nutritious diet, will aid the effect of rest in procuring ankylosis. Intercurrent paralytic symptoms mostly subside, when the disease thus progresses favourably; the spinal cord recovering its functional power. Small doses

of bichloride of mercury—from the twentieth to the sixteenth of a grain, may be given with advantage, as recommended by Stanley.

*Psoas abscess*, or abscess in any other situation, resulting from spinal disease, requires no special treatment. Like any other large indolent abscess, no interference is necessary, until it threatens to burst. A small valvular opening should then be made, to relieve tension without the admission of air; and closed, before the matter has ceased to flow, with a pad of lint and a strip or two of plaster. This procedure may be repeated from time to time, as occasion requires. If the carious disease of the vertebræ be arrested, matter ceases to accumulate; and the abscess contracting with each evacuation, its cavity will at length become closed.

**DISEASE OF THE ATLAS AND AXIS, AND OF THE ATLAS AND OCCIPITAL BONE.**—Caries of the first two cervical vertebræ is less liable to occur, there being less osseous substance than in other vertebræ. Disease begins in their articulations, or in the occipito-atloidean articulations; thus resembling disease of other joints. Swelling and pain, with rigidity or inability to move the head, are followed by abscess presenting behind the pharynx. A broad fluctuating swelling in this situation, extends to either side of the neck, giving the individual a remarkable appearance, grotesque if it were not distressing. Deglutition, respiration, and speech are impaired, the voice having a nasal twang; while with an anxious expression, open mouth and dribbling saliva, the head fixed and supported by both hands under the chin, the patient turns round bodily in looking at anything, and the eyes acquire a peculiar rolling range of motion. Wasting hectic may gradually reduce the sufferer; or his misery terminate suddenly by asphyxia, owing to pressure on the cord by dislocation of the atlas for-



wards, the transverse and accessory check ligaments having given way. The head falls forward, carrying with it the atlas, the odontoid process of the axis compresses the cord, and all is over.

It is said that the atlas may undergo dislocation *gradually*, and even so far forward as to bisect the vertebral canal into equal parts, thus compressing the cord into half its former size, yet without paraplegia resulting. The patient may, indeed, recover, with permanent dislocation and ankylosis. Certain slight defects only will then be observable; a stiff, and somewhat contorted, neck, the chin and face advanced unnaturally, and the back of the head more in a line with the spine, while the spinous process of the axis projects conspicuously.

The *cause* of this disease would appear to be a scrofulous constitution, provoked probably by some slight strain or other injury affecting the neck. Puberty seems to be the age at which the disease commonly begins; but it occurs also in infantile or adult life.

*Treatment* must be the same in principle as that of spinal disease producing angular curvature; absolute rest by fixing the head, counter-irritation when necessary, and tonics.

#### LATERAL CURVATURE OF THE SPINE.

—*Structural condition.*—Spinal Curvature may take place laterally, to one side or the other, and with another or compensating curve to the opposite side; thus presenting a very different appearance from angular curvature forward with a sharp projection backwards. Lateral curvature usually occurs in the middle of the back—mid-dorsal region of the spine, and with its convexity towards the right side; the second curve is in the lumbar region, and its convexity towards the left. This curve arises nearly simultaneously with the first curve, constituting *double lateral curvature*. (Fig. 383.) Sometimes, four curves occur; namely, besides a dorsal and a lumbar, a cervical and a lower lumbar curve are produced, also in opposite directions. There will then be two curves to one side, and two to the other, arranged alternately; the whole spine having a quadruple undulatory form. The

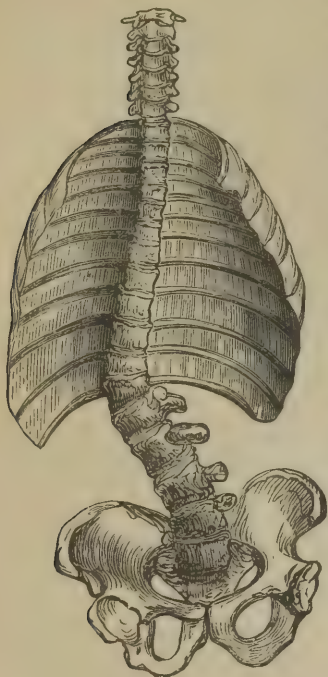
effect of this double and opposite curvation, whether in one or two pairs, is to bring the weight of the trunk over the sacrum, as the base of support, and thus maintain the balance of the body. Another and a remarkable change takes place, concurrently with lateral curvature of the spine. In each such curve, the aberrant vertebræ twist or undergo rotation, to some extent; so that the anterior faces of their bodies look towards the convexity of the curve, the spinous processes towards the concavity. (Fig. 384.) A double kind of curvature—*lateral and rotatory*, is the resulting structural alteration of the vertebral column. The vertebræ themselves become somewhat compressed in their *bodies*, in the concavity of either curve; but there is no apparent disease of the osseous structure.

FIG. 383.



The *ligaments* are simply stretched and somewhat relaxed. The *ribs* conform to the direction of the dorsal curvature; being thrown outwards

FIG. 384.



and upwards on the convexity of the curve—towards the right side, and inwards and downwards, at its concavity—towards the left side. The *thorax*, therefore, bulges on the one side and is depressed on the other. The *pelvis* also, conforming to the lumbar curve; is raised, accordingly, on the side of concavity—the right, and lowered on the side of convexity—the left. Rotation, or the twist of the spine, produces peculiar changes; the thorax projecting backwards somewhat, as well as outwards and upwards, on the right side; and the pelvis backwards, as well as downwards, on the left side.

*Signs, and Diagnosis.*—The signs of lateral curvature are obvious, and correspond to the structural alterations of conformation, above described. On tracing the spinal column from above downwards, by passing the finger along the tips of the *spinous processes*; some unnatural curvature of the *dorsal* spine to the one side, may be perceived, with a compensating curvature in the *lumbar* region to the other side. And this line of undulation will be rendered more visible by marking it with a pen dipped

in ink. But—as urged by Mr. Barwell in his original treatise on lateral curvature—the degree of rotatory displacement cannot be determined by the line of the spinous processes. The tips of these processes—which, until there is considerable displacement, are the only portions of the bones we can feel—are those very parts which in rotation move most away from the side to which lateral displacement tends; thereby allowing considerable displacement of the vertebræ, while the spinous processes still lie in a straight continuous line. *Bulging of the thorax*, beneath and outside the *angle of the scapula*, is an early sign, and followed by projection of this bone—"growing out" of the bladebone, at a later period. This corresponds to and denotes, the *dorsal* curve. A posterior projection of the *innominate bone*, marked by a protuberance backward just outside the *sacro-iliac joint*, is also an early sign; and followed by lateral projection of the *hip*, altering the outline of the figure, at a later period. This corresponds to and denotes, the *lumbar* curve. The priority of a prominent shoulder or of a prominent hip, denotes a curve primarily dorsal or primarily lumbar.

The *front of the chest* presents certain opposite alterations of configuration as compared with its posterior aspect. The right side appears small and depressed, the left prominent. Slighter changes of form can be detected, and the diagnosis confirmed, by an instrument designated the "rotation-measurer."

A primarily dorsal curve presents certain varieties, depending on its causes or mode of production, and which are of practical consequence.

The *weight-bearing curve*—in Mr. Barwell's experience—is uniformly the same; it occupies the upper three-fourths of the dorsal region, and the compensatory lumbar curve commences with the lower fourth vertebra. A perpendicular line from the last cervical vertebra to the middle of the sacrum, crosses the double curve once, at the ninth dorsal vertebra. The most aberrant vertebrae are the fifth dorsal to one side, the second lumbar to the other. A well-marked *vertical rounded eminence* of muscular contraction runs upward from the back part of the ilium to the most aberrant vertebrae.

Other spinal curvatures may be noticed.

The *respiratory curve* varies with its origin; namely, some external cause restraining abdominal respiration, or some internal and pulmonary disease. This curve much resembles that produced by weight-bearing; but the vertical line of muscular development is absent, and the second curve is proportionately less. Curves of *internal* origin assume a variety of shapes; a short and sharp curve, particularly if high up, will probably be the consumptive curvature; a longer curve, high up, results probably from pleurisy; and a long curve low down, proceeds mostly from pneumonia. The situation and form of these dorsal curves, will, therefore, materially determine the diagnosis of lateral curvature, having a respiratory origin.

Both kinds of dorsal curvature—weight-bearing and respiratory, lie to the *right* side, generally; but as respiratory curves are invariably so, excepting in lung disease or the rare instance of visceral transposition, any primarily dorsal curve to the *left*, will be weight-bearing.

*Causes.*—*Age* has an immediate relation to lateral curvature of the spine; this deformity taking place mostly about the age of puberty, and in girls. It would seem that at that period of life, and in the female sex more particularly, the bust and shoulders undergo development and become more weighty, than in proportion to the supporting stability of the vertebral column and its ligamentous connexions. This naturally increased weightiness of the thorax, may be augmented by certain *occupations*, as that of nurse-girls by carrying an infant constantly on one arm. Or again, the erector muscles of the spine, in common with the whole muscular system, may be in an atonic and weakened state, relatively to the increasing weight thrown upon them by the development of the trunk; and this *muscular weakness* is more liable to occur in females as a result of the anæmia of disordered menstruation. Certain occupations which compel an habitual one-sidedness of posture, provoke lateral curvature of the spine; as writing, drawing, playing the harp, or other exercises in the course of school-training. From increasing weight of the trunk, or muscular weakness of the supporting muscles, or both causes, favoured by any occupation, conducive to the operation of either cause; lateral curvature is liable to occur.

But these accredited causes do not explain certain essential characters of this deformity; to wit, the great frequency of dorsal curvature to the *right*, and the production of *rotation*. Assuming that the right arm is heavier than the left and the right lung more capacious than the left, Mr. Barwell attributes rotation to the action of the *serratus muscle*, of this side: which muscle being more weighted and in stronger respiratory action than its opponent, acts upon the ribs as powerful levers, and thus



rotates the vertebræ to the left side. In this etiology, the sequence of events, as usually described by authorities on lateral curvature, is reversed. It is generally stated, that the spine first curves laterally, then rotates, and in this latter movement, by dragging with it the ribs, deforms the chest. The rotation-theory affirms that the ribs are primarily drawn backwards, and acting as levers, twist the vertebræ to the left, curving the dorsal spine to the right.

Both these views cannot be true, but both are entitled to consideration.

*Consequences.*—For some time, the spine retains its flexibility; so that when the cause of curvature is removed, the column regains its natural direction. Consequently, in the recumbent position, recovery temporarily takes place. At a more advanced period of the disease,—after the lapse of some years, the vertebræ become fixed; and then the deformity is persistent in whatever position the patient be placed. Yet recovery can be slowly effected by proper treatment. The general health also is now more visibly impaired; emaciation and pallidity having increased with continued declining nutrition, and there being some symptoms resulting from compression of the thoracic and abdominal organs.

FIG. 385.



*Treatment.*—Any cause in operation must be removed. Thus, any one-sided posture, connected with occupation or habit, must be corrected; and the patient allowed free motion of the body, alternated with rest in the recumbent position. The correction of posture,—in the production of lateral spinal curvature, may be brought about by an antagonistic position. This may be accomplished by using the *sloping seat* (Fig. 385). By uplifting the left side of the pelvis, when depressed by lateral curvature and a lumbar arch formed on the left side, the spine is compelled, by the law of equilibrium, to curve in the opposite direction,—to the right, for maintaining balance; and thus a corrective action is established. The results of this mode of treatment are said to have been “perfectly marvellous.” Various gymnastic exercises have been recommended, and may be of some use; but the ordinary exercise of walking and running, will probably bring both sides of the body into equal

action, and the spine naturally regain a straight direction. This result will be promoted by due attention to the improvement of the general health, on ordinary principles of treatment.

In *single lateral dorsal curvature*—unaccompanied by any compensatory curve in the lumbar region; either of the annexed forms of spinal support may be worn, with much benefit. (Fig. 386 and Fig. 387.)

In a more *advanced stage*, and as *double lateral curvature*, some other mechanical means must be had recourse to for the gradual correction of this deformity. Various contrivances are used, and still more have been constructed; some specialists in this branch of surgery seeming to vie with each other in designing the most complicated apparatus. The thorax, bulging backwards and outwards at the angle of the scapula;

and the hip or haunch, projecting backwards and outwards; both require support, equal and opposite in these directions.

FIG. 386.

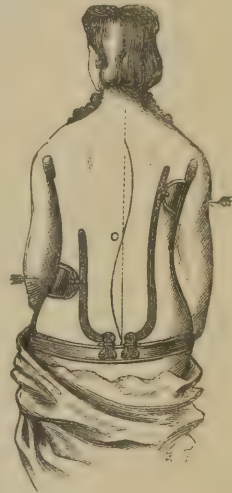


FIG. 387.



The simple "oblique bandage" answers this purpose very well, so far as regards the bearings of the support. Or, a contrivance, similar in character to that used for angular curvature, may be worn, to relieve the weight of the trunk by crutch supports; whereby also the varying degrees of lateral pressure requisite, can be better *regulated* by a rack and pinion worked by a key. The primary dorsal curve may, it would seem, be "unfolded," by extending its extremities (Fig. 388); thus restoring the line of the vertebral column. Unfolding is accomplished, most effectually, by raising the upper extremity of the curve, and supporting its convexity, simultaneously, as shown in figure. Replacement of the ribs and scapula—or, of the projecting shoulder, consequent on spinal rotation, must also be accomplished; and this requirement is specially provided for, in conjunction with rectification of the double curvature, by Bigg's spinal instrument. (Fig. 389.)

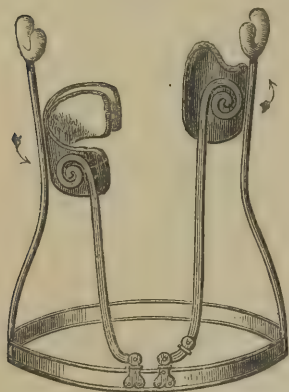
FIG. 388.



*Application of the Instrument*, is thus described by Mr. Bigg, in his *Manual of Orthopraxy*. "Stand behind the patient, and, opening the pelvic band, place it firmly around the hips, in such a manner that the arms rest upon the crutches. See that the two plates press gently against the arc of each curvature, the vertebral levers having been expanded previous to placing the instrument on the patient's body. Fasten the lacing bands in front, and then gradually tighten, by means of the key which belongs to the instrument, the vertebral levers. Lastly, see that the arm-slides are at such a height as to maintain the shoulders parallel with the pelvis, and fasten the shoulder-straps. As a certain amount of irksomeness is sure to be felt on first adopting any kind of mechanical appliance, the instrument should be so worn as to gradually accustom the patient to its

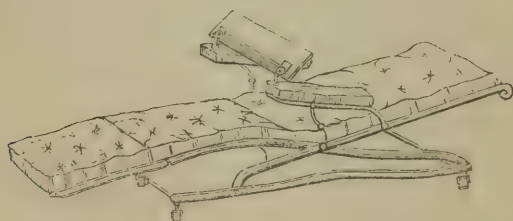
restraint. This is easily done by wearing it for four hours the first day, six the next, eight on the third, and for the whole day afterwards, after which time the patient readily submits to it, and always feels greatly disinclined to part with the apparatus. Where the patient is young, restoration of the spine to its straight position becomes a perfect certainty, provided that great care is bestowed upon the adaptation of

FIG. 389.



the mechanism. The pressure requires to be slightly increased at monthly intervals, and, under no circumstances, should the mechanism be more frequently interfered with. In cases where the patient has almost accomplished her growth, it is highly desirable to keep the instrument applied by night as well as day, thus taking advantage of the slight time left for rapid improvement. In adults, great and beneficial change can be wrought in the position of even the worst form of lateral curvature, but it requires a longer time and more care in adjustment than when a younger person is being dealt with. The mechanical action of the instrument is greatly facilitated by causing the patient to

FIG. 390.



recline on a chair as is here represented (Fig. 390), for two hours daily; as by this means additional rest is given, and also the mechanical powers of the instrument are left to exercise a freer influence than when opposed by the constant reaction of the patient's weight and muscular resistance. In cases where I have tried an instrument only, and in others where recumbency has also been added, a great difference of progress, in favour of the latter course has been observed." By an instrument, similar in principle to this, I have succeeded in arresting the increase of one of the worst cases of double lateral curvature.

Pressure on the dorsal arc, *without* vertical elongation, as the principle of treatment, is represented by the accompanying form of spinal instrument,—which is much advocated and in constant use (Fig. 391).

The *reduction-couch*, of Buhring, is a means of applying the *unfolding* principle of treatment to double lateral curvature, by *recumbency*. And Dr. Bauer of Philadelphia, who highly praises this contrivance, observes that it differs from all other spinal couches, and appliances, in this special advantage; that the pads which act on the vertebral curves, rest against the transverse and spinous processes, instead of upon the lateral surface of the ribs. Compression of the thorax is thus avoided; whilst, from the



thickened shape of the pads, rotation of the vertebræ is induced. The apparatus, as described by Mr. Bigg, consists of a padded metal plate, sufficiently large to admit of the body reclining upon it. Corresponding with the position of the pelvis, a steel band is fixed which surrounds and firmly retains the hips in contact with the couch. Under the left arm an axillary pad, governed by a long screw, is placed, and it raises the concavity of the upper and dorsal curve, whilst, on the convexity of this curve and the right side of the couch, a pad softly covered and shaped like a thick wedge presses upon the transverse and spinous processes of the dorsal vertebræ. On the left side, another pad of a similar wedge-shaped form, but less in breadth and thickness, rests against the spinous and transverse lumbar processes. Both of these pads are moved by horizontal screws, so placed as to admit of the spine being pressed in an antero-lateral direction. The effect of this mechanism is shown in the adjoining sketch, which represents a patient undergoing treatment upon a Buhning couch. (Fig. 392.) It will be seen that the pads not only act upon the body laterally, but also raise the thorax upwards,—thus overcoming

FIG. 391.

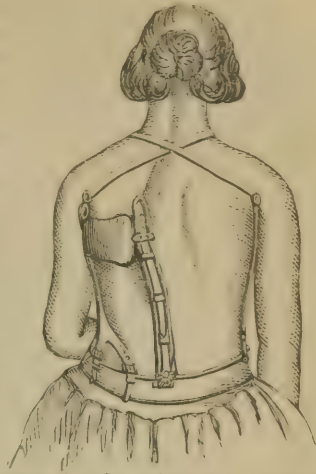
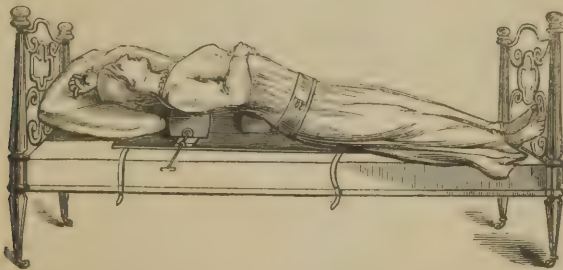


FIG. 392.



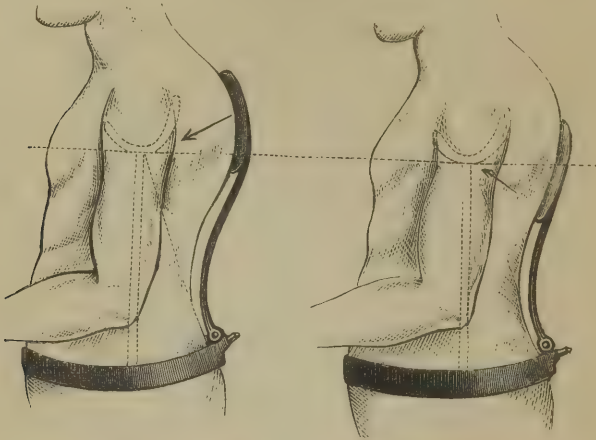
rotation of the spine. As the weight of the body rests almost entirely upon the pads, an antero-lateral movement of the vertebræ takes place,—the spinal curves becoming reduced by a kind of unfolding process, peculiar to this contrivance. A loop of leather fastened to the pillow enables the patient to assist the expansion of the dorsal curve, by holding the left arm across and above the head.

Much care should be observed in the construction of this couch, so that the pads may bear strict relation in their form and thickness to the condition of rotatory-lateral curvature presented by the patient's spine; but as the pads can be easily removed by a simple arrangement in the plate attached to the screw, a very little practice soon determines with accuracy the exact size and thickness of padding required in the individual case. Dr. Bauer says that patients rapidly become accustomed to

the frequent use of this couch and derive the greatest comfort from its use, readily sleeping all night upon it.

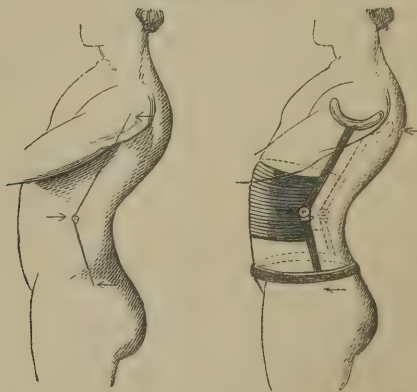
POSTERIOR CURVATURES OF THE SPINE.—*Cyphosis* is a term intended to signify an *excurvation* of the spine in the dorsal region, presenting a remarkably *round-backed* appearance; a deformity which sometimes takes place. (Fig. 393.) The left figure shows this deformity; and an

FIG. 393.



apparatus, which, from the direction of pressure on the spine—*above* the curvature, would increase it; while, the adjoining figure represents the proper situation for spinal support,—*above* two vertebræ *below* the axis of distortion. The most notable instance I have ever seen was in the person of a Surgeon, about fifty years of age, and whose general health remained unaffected. *Lordosis* represents *incurvation* in the lumbar

FIG. 394.



region, and is of more rare occurrence. (Fig. 394.) Both these spinal curvatures appear to be simply an enlargement of the natural curvatures existing in their respective regions; they thus differ from

angular curvature, and also in being unconnected with caries or other disease of the spine.

The *Treatment* should be conducted on the same mechanical principles of counter-support or pressure, gradually applied, as in the management of lateral curvature. The apparatus for *Cyphosis* is represented in the preceding figure. (Fig. 393.) For *Lordosis*, a stay-apparatus should be worn, having upright crutch-supports to relieve the weight of the trunk, but provided with a padded back-plate, or an abdominal band (Fig. 394); the former appliance resembling the apparatus used for anchylosing angular curvature. In the two figures; that to the left shows where the axis of the curve is to be found,—as indicated by the *arrow*; that to the right, depicts the abdominal support, and joint of the upright, so placed as to correspond exactly with the centre of curvature.

SPINA BIFIDA.—*Structural conditions*.—A congenital malformation, signifying the absence or deficiency of the laminæ and spinous processes of some of the vertebræ, with protrusion of the membranes of the cord through the opening thus left in these bones. The sac, formed, contains a thin clear colourless fluid,—cerebro-spinal, which accumulates as the protrusion increases. This structural defect,—resulting from an arrest of development, may occur in any part of the spinal column; in the lumbar region, usually; in the dorsal or cervical region, rarely. The spinal cord and nerves are not generally involved; but above the lumbar region, they are liable to be adherent to the interior of the sac.

The *symptoms* of spina bifida are obvious. A round or oval tumour, varying in size from a walnut to a child's head; lobulated occasionally. Of hard, but elastic consistence, fluctuation is obscure. These characters are most marked when the infant is placed upright, softness and fluctuation becoming perceptible in the horizontal position of the trunk. The tumour subsides also somewhat on pressure, but its tension is alternately increased and diminished by expiration and inspiration.

The *course* of this malformation is uncertain, varying principally according to the size of the tumour. If the sac be small and remain stationary, it may not shorten life. A large sac generally has a fatal termination; death occurs from convulsions, or inflammation and ulceration of the integuments taking place, spinal meningitis supervenes.

*Treatment*.—This also, guided by the probable course of the tumour, will depend on its size. A small sac, with healthy integuments, is best left alone; the patient wearing a soft pad over the tumour, simply as a further protective covering. A larger-sized sac, and with the integuments in the same healthy state, may be restrained by a compress and bandage; an india-rubber air-pad affords the most uniform and elastic support. Increasing tension can be relieved by puncture as occasion requires, and pressure should then be reapplied. Extirpation has been resorted to successfully; but this procedure or indeed any operative interference for removal of the sac is always more perilous than the tumour itself.



## THE THORAX.

## CHAPTER XLIX.

## INJURIES OF THORACIC PARIETES, AND ORGANS.

INJURIES of the chest are of common occurrence in Civil Practice, while they form a very important section of Military Surgery. The grand practical distinctions of these injuries are as follow :—

WOUNDS OF THE PARIETES OF THE CHEST.—These lesions, not penetrating the thoracic cavity, present nothing peculiar in their pathology and treatment. Rest of the injured part will be best secured by means of a broad rib-bandage, thus restricting the breathing to abdominal respiration, as in the treatment of fractured ribs or sternum. This appliance must be removed if the restraint prove distressing to the patient.

INJURIES INVOLVING THE THORACIC ORGANS.—Whatever part of the thoracic parietes be injured—the ribs or sternum—and whatever internal organ be implicated—the lung, heart, or great vessels; certain symptoms are common to these injuries, coupled with special symptoms according to the situation of the injury as implicating a corresponding internal organ.

*Symptoms.*—The shock of injury is always well marked, amounting to extreme collapse.

If the *Lung* be wounded or ruptured, there is also sudden dyspnœa, with a tickling spasmodic cough and bloody-frothed expectoration, or considerable hæmoptysis of pure blood. The air inspired, escapes at the seat of pulmonary lesion, into the cavity of the pleura; constituting *pneumothorax*, with proportionate *collapse* of the lung. If the costal pleura also be wounded, the imprisoned air passes, during expiration, from the pleural cavity externally, infiltrates and distends the cellular texture, perhaps very extensively; thus constituting *emphysema*. Hæmorrhage taking place into the pleural cavity is known as *hæmothorax*. An external wound of the integument, as a penetrating wound of the thorax, presents certain distinctive symptoms; air escapes and is drawn in alternately during the act of respiration, and the lung may protrude to some extent through the thoracic aperture, forming *hernia* of the lung.

The consequences of injury to the lung may be; inflammation of that organ—*pneumonia*; and with regard to the pleura—*pleurisy*—terminating perhaps in pus-formation and its accumulation, within the pleural cavity—*Empyema*.

If the *Pericardium* or the *Heart* also, be injured; then, in addition to the extreme collapse, the only peculiar symptoms will be as connected with the pericardium; hæmorrhage taking place into its cavity, or inflammation of that membrane—pericarditis ensuing, when life is sufficiently prolonged for this event.

Different parts of the heart are liable to be wounded, and according to Ollivier's inquiries, in the following order of frequency; right ventricle, left ventricle, the apex or base, right auricle, left auricle.

Rupture of the heart occurs also in different parts of the organ, with some relative order of frequency—as shown by Gamgee's collected cases.

Of 27 instances, in at least one-half, the pericardium was entire; in 12 the rupture was on the right side, in 10 on the left. The right ventricle was ruptured in 8, the left in only 3 cases; whereas, the left auricle was torn in 7, the right in only 4 cases.

*Causes.*—*Fracture* is the most frequent form of thoracic injury in connexion with wound of the lung, the pericardium or heart; the ribs or the sternum, respectively, being the seat of fracture, and the broken ends of bone, thence driven inwards, being the immediate cause of the injury to either thoracic organ. *Contusion* or *compression* of the chest, without fracture, as by a violent blow or squeeze, may directly rupture the lung, pericardium, or heart. The latter organ has been ruptured by indirect violence; as by a fall on the head, shoulder, or lower extremities. Spasmodic contraction of the heart under the influence of great mental emotion, is also said to have caused rupture; the unhappy sufferer dying literally of a broken heart. Lastly, a *penetrating wound* of the chest, as by a stab, a bullet or other gunshot injury, may also directly implicate either organ; but this occasion of internal injury is comparatively rare in civil life.

*Prognosis.*—Wounds of the *Lung* are always perilous, but less so than similar injury of most other viscera. The cause and depth of the wound will mainly determine the prognosis. Thus, a wound produced by a fractured rib is rarely fatal, either in itself or its consequences; whereas, contusion causing rupture of the lung, is frequently more serious; and a penetrating wound is always dangerous, proportionately to its depth. Hence, a stab may soon prove fatal, although I have seen a case where the lung was penetrated by a fork, as shown by the bloody expectoration, and yet the patient soon recovered. A bullet-wound is most perilous, owing to its depth and the uncertain extent of the injury; perhaps implicating the root of the lung. More than half the cases of gunshot wounds of the chest, die. After the battle of Toulouse, of 106 such cases, nearly half died; and of 40 cases at the Hôtel Dieu, 20 died. Of 147 cases in the British Army, during the Crimean War, 120 died; and of 200 cases in the Russian Army at the siege of Sebastopol, only 3 recovered. The usual cause of death is hæmorrhage, primary or secondary. And thus, according to Hennen, death generally ensues before the third day; after which, if the patient survive, the prognosis will be favourable for recovery, subject to the contingencies of inflammation and its consequences as affecting the lung and pleura. Wound of *both* lungs simultaneously is proportionately more dangerous; and principally owing to double pneumothorax with collapse of the lungs, inducing more complete asphyxia. Recovery is however an occasional termination, even in such cases.

Wounds of the *Heart* are generally fatal, and almost immediately, from internal hæmorrhage and collapse. Sometimes, life continues for a period of some duration; the patient may have walked or run a considerable distance before falling down dead. In 29 cases, collected by Ollivier and Sanson, of penetrating wounds of the heart, forty-eight hours elapsed before death ensued. But here again, the extent of the wound, its direction, and the cavity of the organ injured, are very material prognostic considerations; when any such particulars can be ascertained during life from the mode in which the injury was inflicted. Thus, a wound in the direction of the axis of the heart is not so speedily fatal as a transverse wound; and a wound of the auricle is more immediately fatal than that of the ventricle; this difference depending probably on some obstruction to the free escape of blood being offered by an irregular contraction of

the muscular fibres, owing to their structural arrangement, in the wall of the ventricle. In exceptional cases, life may be prolonged for some days, or recovery has been known to occur, and even although a foreign body remain lodged in the heart. In one instance Ferrus relates that a man lived twenty days with a skewer transfixing the heart from side to side. In another case, a boy lived five weeks, with a piece of wood, three inches long, sticking into the right ventricle; as discovered after death by Messrs. Davis and Steward. A soldier, whose case Latour records, lived for six years after a wound in the right ventricle, from a musket ball which remained lodged against the septum; and Carnochan relates that a man lived eleven days with a bullet deeply buried in the apex of the heart.

*Rupture* of the heart, without penetrating wound of the chest, is generally fatal almost instantly; but life may be prolonged for some hours, fourteen hours elapsing after rupture of the right auricle, as recorded by Rust.

In two instances on record, the chest has been completely transfixed, and yet the individuals recovered and lived for years afterwards. One such case occurred in the person of a sailor, whose thorax, through the cardiac region to the back, was transfixed by an iron-pointed shaft which fell on him from a height on board ship, pinning him to the deck. The shaft was with some difficulty extracted through the chest. I had an opportunity of examining this man many years afterwards, and he was then in good health and without thoracic inconvenience. I communicated a report of the examination I made, to the *Lancet*, about 1859; the exact date I cannot find, while writing this reference. In another instance, transfixion of the chest by the shaft of a chaise was followed by recovery of eleven years' duration. The original history of both these remarkable cases with the instruments of penetration, are preserved in the Museum of the Royal College of Surgeons.

*Treatment.*—A penetrating wound of the chest presents certain general indications of treatment. (1) Hæmorrhage must be arrested. The wound may be accompanied with hæmorrhage from two sources; the arteries of the parietes, or the vessels of the lungs. The former are rarely the source of hæmorrhage. An *intercostal artery* is seldom wounded, the vessel lying under cover apparently of the groove in the lower border of the upper rib of the two. Yet occasionally the artery bleeds freely. The integumental wound must then be enlarged, if necessary, to reach the bleeding vessel, which may be secured by ligature or torsion. Compression may sometimes be more practicable; and this is best accomplished by introducing a piece of rag in the form of a bag, and stuffing it with small pieces of lint, so as to compress the vessel effectually on drawing the stuffed bag outwards. The internal mammary artery, which is rarely wounded, must be ligatured or twisted, the external wound being enlarged when necessary for this purpose. The costal cartilage overlaying the artery may be divided in order to reach the vessel. Blood extravasated into the anterior mediastinum or the pleura, can be partly withdrawn through a female catheter or by the application of a cupping-glass. *Pulmonary* hæmorrhage is the chief source of danger; but the treatment is constitutional, and will be specially noticed after completing the local management of the wound. (2) Foreign bodies are sometimes discovered on carefully examining the wound by gently introducing the finger. A probe should never be used, lest a simple integumental wound



be thus accidentally converted into a penetrating wound of the chest. Any foreign body within reach that can be fairly extracted, or by enlarging the wound, must be removed; such as clots of blood, a splintered bit of rib, or a bullet. If not accessible, the substance had better be left to find its way out; or, remaining within the chest, it may lead to the formation of abscess and be coughed up with purulent expectoration; or, the body may become encysted and quiescent, thus lodging in the chest for years. A bullet has been known to continue rolling loosely about in the pleural cavity. (3) The closure of a penetrating wound of the chest, should be determined by two considerations; the probability of a foreign body still remaining in the wound, and by whether the lung be wounded. A *small* puncture, without the escape of air and blood during expiration, and unaccompanied with bloody expectoration, is a condition which permits of the wound being closed. This can be done effectually by means of the ordinary appliances; one or two sutures perhaps, a pad of lint and strips of plaster. A rib-bandage may be applied to restrict the breathing to abdominal respiration.

A wound of the chest which involves the *lung*, air and blood escaping through the wound from the injured lung, is a condition wherein the external wound should not be closed. Water dressing may be applied, but the patient should be placed on the wounded side, in order that the air and blood may be freely discharged. Pneumothorax and the tendency to emphysema, and perhaps hæmothorax, will probably thus be prevented. This general rule, as to the position of the patient, must not be made absolute. If the position prove intolerable, he may be allowed to lie in whatever position is most comfortable to him; but the almost inevitable consequences of an unsuitable position should not be overlooked.

*Constitutional* treatment consists in the remedial measures appropriate for arresting pulmonary hæmorrhage. Perfect quietude, so that the breathing shall be as placid as possible, must always be enjoined; for healthy pulmonary texture evinces a strong natural disposition to heal. Astringents may then be administered with advantage, and in particular gallic acid, alum, or acetate of lead and opium. Opiates are also remedial by ensuring sleep, and diminishing the respiration. The efficacy of blood-letting in reducing the force of the circulation, as originally inculcated by John Bell, Hennen and Guthrie, was corroborated by the large experience gained during the Crimean War. Venesection should be had recourse to early and copiously, sixteen or twenty ounces of blood being drawn at once, and repeated to a lesser amount again and again, whenever necessary to suppress hæmoptysis. I am in favour of one decided, and as it may be termed, knock-down blood-letting, when the pulmonary lesion will probably undergo repair sufficiently to arrest hæmorrhage before the pulse rises and bleeding can recur.

*Inflammation* supervening after about the third day, it should be met by the usual antiphlogistic treatment; with this difference, that antimony and mercury are scarcely appropriate, owing, as Mr. Lawson has observed, to their influence in checking the exudation of plastic lymph requisite for the reparation of the wounded lung.

*Secondary* hæmorrhage may arise from inflammatory excitement of the circulation, or after gunshot wound, by the detachment of sloughs, either from the lung, or from an injured intercostal artery. Venesection is the remedy in the first case; and astringents in the latter two, with

ligature or compression in the third case. The pleural cavity may have become filled, and the lung compressed by air, extravasated blood, or inflammatory effusion, serous or purulent; the wound should then be opened with a probe-pointed bistoury and free vent given to any such collection.

**HERNIA OF THE LUNG OR PNEUMATOCELE.**—Protrusion of the lung may follow a penetrating wound of the chest; or, arising after the external wound has healed, it appears under the cicatrix; and it has been produced by fractured rib without wound, or by any violent straining effort, as during labour. Always a rare accident; the protrusion is only properly speaking hernial, when covered with integument, a very rare occurrence. Any part of the thoracic parietes is liable to hernia of the lung; but more especially one or other side of the chest. The tumour may attain a large size.

**Treatment.**—With an external wound, and the protruding lung in a healthy state, it may be returned into the thorax; and the treatment otherwise is that of a penetrating chest wound. Or, the protruding portion of lung may be allowed to remain as a plug to the pleura, according to Mr. Guthrie's recommendation, when it soon granulates and heals over. This should certainly be the rule if the lung be in a sloughy state. Such an exposed portion has been known to slough away. It has also been removed surgically and successfully, even although of considerable size. Tulpius ligatured a gangrenous protrusion of the lung, and cut it off with scissors. The piece removed weighed three ounces, yet the patient entirely recovered. Hernial protrusion must be supported by a truss.

**PNEUMOTHORAX.**—Distension of the pleural cavity with *air*, and an accompanying collapse of the lung, is denoted by certain marked signs; tympanitic resonance on percussion, with an absence of the respiratory murmur and an increased or puerile respiration on the opposite side of the chest, as discovered by auscultation. The breathing is of course embarrassed in proportion to the pleural distension and pulmonary collapse.

The *causes* of this condition are, surgically, any occasion of wound of the lung; whether by a fractured rib, rupture from thoracic compression, or a penetrating wound of the chest, as by a stab or bullet. But pneumothorax may also arise from a diseased state of the lung, as the bursting of a pulmonary abscess into the cavity of the pleura; air and fluid thus co-existing in this cavity, the fluid below and the air above. Two distinctive signs are then presented; a splashing sound elicited by succussion or shaking of the chest; and metallic tinkling, a clear, silvery, bell-like sound, resulting from the dropping of fluid occasionally from the pulmonary orifice into the fluid collected at the bottom of the pleural cavity. Coughing will frequently elicit this sound.

**Treatment.**—The relief of pneumothorax is easily accomplished by tapping or puncturing the chest so that the accumulated air shall escape from the pleura,—the operation of Paracentesis Thoracis. But the causes of which pneumothorax is itself only symptomatic must then be attended to, as in the treatment of a penetrating wound of the chest.

**Emphysema.**—Distension of the *cellular texture* with air frequently accompanies pneumothorax; although either condition may occur independently. Emphysema almost necessarily depends on a wound of the costal pleura, in conjunction with that of the pulmonary pleura; air escapes into the pleural cavity with each inspiration, and is expelled

thence into the cellular texture. If the lung be bound down by adhesion at the seat of both apertures, the air passes directly into the cellular texture; emphysema arises without any previous pneumothorax. An external penetrating wound will also allow air to pass directly into the cellular texture, thus giving rise to emphysema.

A rare mode of production, which Mr. Hilton has described, is by rupture of the pulmonary texture alone; air passing into the posterior mediastinal cellular texture, along the course of the nerves and vessels, thence to the neck, and downwards along the sheaths of the arteries to the limbs.

The *signs* of emphysema are distinctive; a swelling, diffused, somewhat elastic, but plainly crackling under pressure with the fingers, and without any discoloration of the integument. This swelling arising in the neighbourhood of a fractured rib, or around the margin of a penetrating wound, gradually extends through the cellular texture over the thorax. Sometimes it passes up into the neck and arms, and downwards to the lower limbs; such general emphysema presenting the singular appearance of a stuffed figure scarcely human; and as the internal organs become involved, dangerous symptoms ensue, particularly dyspnoea, threatening suffocation.

*Treatment* specially for this condition may not be requisite. The air infiltrated often undergoes absorption rapidly, and the swelling disappears. Bandaging may have some repressive and absorbent effect. Punctures well placed more decidedly control the spread of emphysema; and an external wound, when present, may sometimes be opened with advantage to aid in discharging the imprisoned air. Should respiration become oppressed, venesection freely employed, will often afford the most marked and instantaneous relief. I cited a case in point from my own observation, when treating of fracture of the ribs.

**HÆMOTHORAX.**—The presence of *blood* in the pleural cavity gives rise to different symptoms from those of Pneumothorax. Hæmorrhage may be suspected by dulness on percussion, with absence of the respiratory murmur, dyspnoea more or less urgent, and collapse; arising in connexion with a fractured rib, or a penetrating wound of the chest. The blood may proceed from the lung or an intercostal artery. Secondary hæmorrhage, and the circumstances under which it supervenes, may also produce hæmorthorax. Blood thus extravasated soon undergoes putrefactive changes, and leads to the formation of pus in the pleural cavity—*empyema*.

*Treatment.*—An early opening must be made, both to relieve the breathing and to prevent the risk of empyema. Advantage should be taken of an external wound to make that the vent; a probe-pointed bistoury being carefully used to free the opening. A cupping-glass may be applied to withdraw the blood, if it be not readily discharged. If the hæmorrhage be *persistent* and symptoms of hæmorthorax return, the plan recommended by Guthrie may become advisable. The wound is to be closed, so that the blood accumulating in the pleural cavity may compress the orifice in the lung, and thus arrest any further hæmorrhage; the patient lying on that side as an additional pressure on the wounded and bleeding organ. After the lapse of six or eight days, the wound should be reopened, or tapping may be performed, to evacuate the imprisoned blood; which, if allowed to remain longer would probably provoke empyema.

**HYDROTHORAX.**—A collection of *serous fluid*, or water, in the pleural



cavity, may be the result of pleurisy: but more commonly the condition arises from disease of the heart or lungs, obstructing the circulation. Both sides of the chest may be affected.

The signs are those of empyema, without the accompanying hectic fever.

Treatment surgically has regard only to the relief of dyspnoea by evacuation of the imprisoned fluid,—the operation of paracentesis thoracis.

**EMPYEMA.**—A collection of *pus* in the pleural cavity is usually the consequence of pleuritis; induced by a wound of the pleura from a fractured rib, or a penetrating wound of the chest. The lung, may, or may not, be implicated. Occasionally, the irritation of a carious rib, or the bursting of an abscess into the chest, is the cause of empyema.

The *signs* are, dulness on percussion and absence of the respiratory murmur at the lower part of the chest, up to the level of the fluid; this varying with the upright or recumbent position of the patient. *Ægophony*—a bleating or reedy voice sound, something like Punch's voice, is heard at the upper part of the chest; owing probably to a thin layer of fluid rising up between the two layers of pleura, through which the voice is transmitted, as a broken vibratory voice, from the larger bronchial tubes. Pus continuing to collect in the pleura, the line of percussion dulness gradually rises higher and higher; until the whole side of the chest emits a wooden sound on percussion, and neither breath nor voice sound can be heard. The affected half of the thorax is increased in size, visibly and palpably, and as shown by measurement, compared with the opposite side. The intercostal spaces are widened and bulge outwards between the ribs; while the lung is compressed backwards towards the spine, becoming consolidated like unto the consistence of india-rubber, and ultimately perhaps not larger in size than a fist. Empyema of the left pleural cavity displaces also the heart towards the right side; or if it occur on this side, the liver is depressed by the pleural accumulation. Dyspnoea is more or less urgent as the disease progresses, and the usual hectic fever results from continued suppuration. The abscess may point and burst externally, between the ribs.

*Treatment* surgically, consists in evacuation of the imprisoned fluid.

**PARACENTESIS THORACIS.**—Tapping the chest is an operation for the evacuation of any fluid—air, blood, serous-fluid, or pus, collected in the pleural cavity; but it is especially and more commonly performed for the relief of the latter accumulation,—empyema.

The spot selected for puncture is wherever the abscess may have pointed, or where there is decided dulness,—that the lung shall not be wounded; and the place usually chosen is in the fifth intercostal space, at about its middle on the side of the chest. This about corresponds to the insertion of the serratus magnus. A slight incision is made at this spot,

FIG. 395.



with the point of a bistoury; a large-sized, flat-shaped trocar (Fig. 395),

is then thrust slantingly over the *upper* margin of the sixth rib, thus avoiding the intercostal artery, and passed through the pleura. The trocar is withdrawn and the fluid drawn off through the canula. Air is liable to enter the thorax towards the end of the stream; it having become almost dribbling, air may then be sucked into the pleura during expiration, to fill up the thoracic space unoccupied by the collapsed lung. Decomposition of the purulent fluid would thus be induced, and severe or fatal constitutional disturbance. To obviate any such risk, the canula should be provided with a stop-cock, which is turned as the trocar is withdrawn; an india-rubber bag is then attached to the projecting end of the canula, and the fluid safely drawn off; the stop-cock being turned, and the bladder emptied and reapplied, as often as may be necessary to evacuate the purulent collection. A modification of this method is preferable. A long india-rubber tube, instead of the bag, having been fixed to the canula and its free end placed in a basin of water; the fluid is drawn off as safely under water, and with the advantage to the Surgeon of his being enabled to see when the stream ceases. On withdrawing the canula, a pad of lint is slid over the puncture-orifice in the integument, and secured by strips of plaster. A rib-bandage may be used to restrict thoracic respiration. The *drainage-tube* of M. Chassaignac, and adopted by Dr. Goodfellow and Mr. De Morgan, may be employed to prevent any reaccumulation of pus. A long iron probe, slightly bent, is introduced through the trocar-opening, and pressed against an intercostal space posteriorly, as low down as possible. The projecting end having been distinctly felt, it is cut down upon, and pushed out. A silk thread carrying the drainage-tube is attached to the eye of the probe, and on withdrawing the probe at the lower opening, the drainage-tube follows through the pleural cavity; the ends of the tube, projecting from the opposite openings, are tied together, and the purulent fluid drains away, *guttatim*, as it forms. I remember to have read a case in which Mr. Berkeley Hill adopted this resource, in an old-standing empyema, and with most marked advantage to the general health.

**HYDROPS PERICARDII.**—A collection of water in the pericardium may result from the same causes obstructing the circulation, as those of hydrothorax; the two conditions not unfrequently co-existing.

The *signs* are; percussion-dulness, extending over the whole pericardiac region, and absence or muffling of the cardiac impulse, with perhaps an obvious fulness to the eye, and to the hand placed over this region. There is constant præcordial oppression and dyspnoea, particularly in the recumbent posture, and faintness on exertion.

*Paracentesis Pericardii* may be employed as a last resource. A spot of the greatest dulness having been selected; a slight incision is made in the intercostal space, and a small trocar passed obliquely into the pericardium.

**DEFORMITY** of the Chest and Spine will inevitably result from pleurisy with extensive adhesion, or from tapping the chest, as for empyema, when the lung cannot sufficiently undergo expansion. In either case, the side of the chest collapses to meet the inactive lung, and there is more or less flattening deformity.

No mechanical contrivance will be able to control this result. The case is best left to nature, and if the patient be young, he may outgrow the deformity.

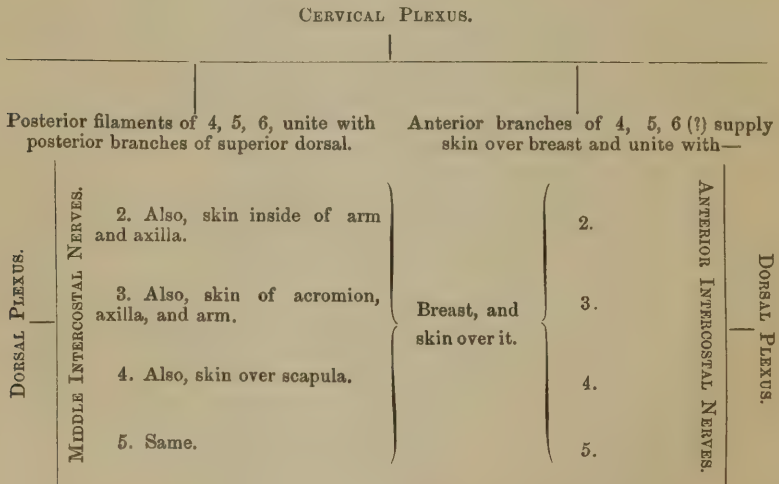
## CHAPTER L.

## DISEASES OF THE BREAST.

IN considering Diseases of the Breast, it is absolutely necessary to regard the Mammary Gland in its physiological and anatomical relations; through the nervous, vascular, and lymphatic systems.

The Breasts,—meaning thereby the Mammary Glands, are intimately related, physiologically, with the organs of reproduction, in the female. A healthy condition of these organs is associated with a healthy state of the breasts, and both undergo, concurrently, corresponding differences of functional activity at different periods of life;—before puberty, at puberty, and subsequently, periodically during the menstrual period, and during pregnancy, parturition, and lactation.

The anatomical relations of the breast have reference principally to its intimate nervous connexions; by the distribution of the spinal nerve-filaments to the skin over the gland, to the gland itself, and their connexions with the cutaneous filaments of the contiguous regions. This nervous system of the breast, and its source of supply from the general nervous system, is clearly exhibited in the following diagrammatic scheme of *innervation*, by Mr. Birkett.



It should be read thus. The breast and superimposed skin are supplied by filaments from the anterior branches of the 4th and 5th cervical nerves. Filaments from the posterior branches of the same nerves join with others from the superior dorsal nerves. Filaments from the middle and anterior intercostal branches of the anterior division of the 2nd, 3rd, 4th and 5th, nerves of the dorsal plexus, supply the breast



and skin over it chiefly. A minute examination demonstrates the association between the 2nd intercostal and filaments supplying the skin of the inside of the arm and axilla; also the same parts, and the skin about the shoulder from the 3rd; and the skin about the scapula from the 4th and 5th. These nervous intercommunications explain the widely-extended pain of which patients so grievously complain when affected with mammary hyperæsthesia.

*Arteries and veins.*—The 2nd, 3rd, 4th, and 5th, intercostal branches of the internal mammary artery usually supply blood to the sternal segment of the breast; within the axillary portion, a large branch from the axillary artery commonly ramifies; and the inferior and lateral regions receive a few branches from the intercostal arteries which accompany the nerves through the middle intercostal foramina. The *veins* accompany the arteries and terminate in the internal mammary and axillary trunks. The subcutaneous veins around the areola, are arranged in the form of a circle,—the *circulus venosus areolæ* of Haller. The superficial veins, ramifying over the breast, are often dilated, and present a blue, open network.

*Lymphatic vessels.*—The superficial lymphatics pass through the axillary, the cervical, and anterior mediastinal glands; a deeper series pass over and beneath the pectoralis major muscle to the glands under the clavicle.

GENERAL PATHOLOGY AND DIAGNOSIS OF DISEASES OF THE BREAST.—The mammary gland is liable to the same kind of diseases as other organs; but the physiological relations of this organ give it an almost specially wider range of pathological significance, it being the scene of sympathetic uterine affections, and of inflammation and morbid growths, as perversions of nutrition,—the liability to which varies according to the functional activity or quiescence of the gland.

The general *diagnosis* of diseases of the breast must have reference, therefore, to the following considerations, which may be conveniently embodied in the following inquiries, taken successively:—Has the disease, in question, any manifest connexion with the age of the patient; the stage of development of the gland; its functional activity or repose; and the social condition of the patient, as to marriage, &c.? Does it seem to be associated with any disturbance of the functions of the generative organs? Is it merely a local affection, or more intimately connected with general constitutional dyscrasia? Is it of inflammatory origin? Is it traceable to a morbid state of the excretory ducts, or of the secreting structure of the gland? And lastly, is the swelling, tumour, or tumefaction really produced by something growing in the breast,—a new growth, infiltrating the tissues of the breast, inflammatory or otherwise; or simply a morbid condition of a part or whole of the actual tissue of the organ,—an excited state of the gland-structure;—in short, is the disease superadded to the gland, or a morbid state of the gland-structure?

It will be observed that this sequence of inquiry is analytical, and that it proceeds in the order of exclusion; both of which aspects of inquiry are most valuable in clinical teaching and in personal investigation. But he who has been thus trained, will come at last to conduct such inquiry unconsciously, or to cut it short, by at once associating the leading characters of the disease, in his recognition or diagnosis of that disease.

*Method of examining the Breast.*—The following practical directions—according to Mr. Birkett—will be found to facilitate the diagnosis of a

morbid lobe of gland-tissue from a new growth. Press the indurated part gently between the thumb and fingers, and a tumour is so distinctly felt that the positive existence of something superadded to the breast is affirmed; but now place the fingers lightly and *flatly* upon the part over the site of the supposed new growth, pressing gently against the thorax, and nothing more than the ordinary gland-tissue is perceptible. On the contrary, if there be a genuine new growth, something developed recently within the normal gland, it will be always felt, in whatever manner or in whatever position the patient is examined. For perfect accuracy of diagnosis, the breast should be examined whilst the patient is seated, and also when placed in the recumbent posture.

**INFLAMMATION.—MASTITIS.**—The earliest change is induration more or less intense, and involving one or more lobes of the gland. Uneasiness, rather than pain, is experienced in moving the arm or in the act of suckling. The lump, knot, or coring of the milk, as it is termed, is due to congestion of the milk in the part affected. This congestion and induration increase with variable rapidity, and the whole gland becomes involved. Integumental swelling and redness supervene with acute pain, and considerable constitutional disturbance or inflammatory fever.

*Suppuration* takes place, and pus collects in the breast, behind it, or on its cutaneous surface. The formation of mammary abscess may, therefore, be either *super-mammary*, *intra-glandular*, or *sub-mammary*. These different situations of abscess can only be distinguished by careful palpation with the fingers, as to the depth of fluctuation. Sub-mammary abscess is the most characteristic. The breast seems to rest upon and be projected by something behind it, and which yields on slight pressure, the elastic fluctuation of an air-cushion. The matter progresses towards the integuments slowly; it points very often, at several spots around the circumference of the gland, or making its way between the lobular masses of the organ, an opening forms near the areola towards its sterno-clavicular border.

*Causes.*—Inflammation of the breast occurs commonly in the adult female, and during lactation; leading to the formation of *milk abscess*. During pregnancy and weaning, the inflammation happens very rarely; more commonly during the former than the latter period, and when at the time of weaning, it is usually excited by an abrupt discontinuance of suckling—owing to the death of the infant or illness of the mother. Some local irritation, not unfrequently, induces it; especially ulceration of the nipple, obstruction of a milk duct, contusion or exposure to cold; and occasionally a diseased state of the axillary glands. On the other hand, the inflammation very rarely arises before puberty, about that period, or during the inactive state of the gland.

*Treatment.*—The usual treatment of inflammation is here applicable, but it should be had recourse to at an early period; in order to anticipate as far as possible the known circumstances under which the disease usually arises, and prevent its suppurative consequences in the destruction of the breast.

In the first instance, repressive measures should be employed; cold lotions, or the extract of belladonna thickly spread on strips of lint and well applied over the whole breast, a most effectual repressor of incipient inflammation concurrent with lactation; occasionally, leeches may be advisable, and derivative aperients when circumstances permit. Additional, and special, relief is afforded by emptying the gland-tissue of its secre-

tion; removing, in fact, lactic congestion. Suckling need not be abandoned, but it may be necessary to remove the milk mechanically, by means of the breast-pump. The arm of the affected side should be placed at rest, and the weight of the breast supported on the patient's chest; or if she lie sideways, a pillow or loop of broad bandage may be requisite. Established inflammation with redness of the skin, and almost inevitable abscess, must be met by warmth and moisture; poultices, to limit the inflammation and induce suppuration of a circumscribed character, and facilitate pointing of the abscess. The usual rule of an early, free, and dependent opening is here imperative. The support of a bandage will then be requisite to prevent any tendency to bagging of matter; and subsequently, to promote absorption of the remaining induration, when the pressure of cross-strapping with long strips of adhesive or soap plaster will probably afford a more even and suspensory support to the breast.

*Chronic inflammation* may be the consequence of acute inflammation, or arise independently as a scrofulous affection. Induration and swelling of the breast, in part or of the entire breast; is usually followed by suppuration, burrowing, and sinuses or fistulæ of an obstinate character.

Chronic abscess must be distinguished from cystic tumour of the breast. Both having a painless and an indolent character; the history will partly distinguish abscess, and puncture with a grooved needle will always determine the diagnosis.

The *treatment* consists in the evacuation of matter, as occasion requires, and the support of strapping or bandaging; with a tonic and nourishing course of general treatment. Chronic sinuses may be closed by stimulating injections, or by laying them open as a last resource. Milk fistulæ will not usually heal until the secretion of the gland is arrested.

*Scrofulous enlargement*, or tumour, of the Breast, is a result of mammary inflammation in scrofulous subjects. This affection is occasionally met with. Tuberculous deposit also is noticed by Velpeau, and as occurring in two situations; in the gland, or in the skin and subcutaneous cellular textures. The *axillary glands* are sometimes the seat of this deposit. Thus, I removed a conglomerate bunch of these glands from the axilla of a middle-aged, single woman; the deposit being yellow, opaque tubercle, mixed with cretaceous matter.

*Inflammation of the Nipple*.—This affection often arises during suckling, and leads to superficial ulceration or excoriation as *cracks*, *fissures*, or *chaps*. Great pain attends the act of suckling, and inflammation of the breast may be induced.

*Treatment*.—Frequent ablution with warm water often proves more remedial than lotions, ointments, or other applications. These may be simply protective; as collodion, glycerine, almond oil, or some dry powder, as prepared chalk or flour dusted around the nipple; stimulating applications, as a touch with nitrate of silver; astringents, as tannin or zinc ointment; and narcotics, to relieve pain. The difficulty is to manage the breast in a state of secreting activity, and the suckling of the child, the nipple or perhaps both nipples being sore. Some of the above mentioned applications would be decidedly poisonous to the infant; narcotics in particular. Various shields have been devised to protect the nipple from the pressure and dragging caused by the act of sucking; and such a contrivance will also shield the infant's mouth from any noxious matter left around the nipple, by the use of these curative applications.



*Abscess of the Nipple* or of the areola, has no special characters or treatment.

Other diseases of this part, as tumours, are not peculiar.

CHRONIC INDURATION of portions, or of the whole of the mammary gland is another common condition; the induration having a finely *lobular* or *granular* character, owing to the acini or cæcal terminations of the lactiferous ducts being gorged with epithelium. This state of the gland may be found in breasts of all sizes and shapes; in the large, heavy, pendulous breast; and in the small, atrophied, disc-shaped organ. The one feels like a great ball under the integuments; the other, under which the tips of the fingers may be inserted, feels like a quoit covered with skin. Indurated portions simulate tumours formed by a new growth; but, although distinctly felt when pressed between the finger and thumb, when pressed flatly against the chest, any such portion is imperceptible as a hard mass. Great tenderness, and even pain amounting to agony, on the slightest handling, is often experienced; the patient's face becoming suddenly suffused with a bright red blush, or pallid, while a sensation of nausea or faintness oppresses her. The pain has two other characters besides its intensity; it is widely distributed, shooting up the neck, or behind to the back and particularly to the scapula, and often down the arm; and this pain may be traced to the middle or anterior branches of the intercostal nerves, which are painful on the slightest pressure, the filaments of the painful nerve or nerves being distributed to the indurated portion of the breast; the pain is also paroxysmal, and it may pass from one breast to the other as an alternate affection. No trace of any inflammation of the integuments can ever be discovered. The general health is much disturbed, and the nervous system highly excited.

The *cause* of chronic mammary induration seems to have reference to functional derangements of the generative organs, and which may be of an opposite character; amenorrhœa, menorrhagia, dysmenorrhœa, or commonly profuse leucorrhœa. Unmarried women, between twenty-five and forty years of age, are most subject to these indurations; and of the married, sterile women are far more frequently affected.

*Treatment* is chiefly constitutional; tonics, such as iron, quinine, the mineral acids, and occasionally sedatives, have the most beneficial influence, coupled with the hygienic regimen of hysteria. Menstruation may sometimes be rectified by remedies which directly influence that function. Of topical applications, evaporating lotions and sedatives are most appropriate; and when the breast will bear pressure, simple strapping, or with emplastrum ammoniaci cum hydrargyro, may aid in dispersing the induration.

IRRITABLE MAMMA.—A condition of hyperæsthesia or exalted sensibility of the skin covering the breast, as well as of the gland itself, is not an uncommon affection. The breast is somewhat enlarged, firm and conical, the nipple swollen, and the skin generally reddened. But the *pain* is the most prominent symptom, it being induced by the slightest touch, and even by the gentlest contact of the dress. It is very widely distributed, and paroxysmal, alternating possibly from one breast to the other.

Young girls are more subject to this affection than women above the age of twenty-five; and it seems to be of uterine origin, but is probably induced by depraved habits.

The *treatment* is similar to that of chronic induration of the mamma.

HYPERTROPHY.—Simply an overgrowth of the gland itself, is a very

rare modification of the nutrition of this organ. The size attained may be enormous; the two overgrown breasts being a perfect burden and misery to the individual.

Hypertrophy of the breast occurs in two forms, presenting a very different appearance; the large, firm, globular breast, with tense over-spread integument; and the large, flaccid, pendulous breast, with shrivelled, wrinkled integument, the component masses of the gland having a loose connexion, and the nipple small, although the areola is of larger area than usual. Occasionally, the latter form of hypertrophy, is associated with a new growth—an adenocoele.

The *cause* of this mammary hypertrophy seems referable to uterine derangement. It commences soon after puberty or in early adult life; in single as well as in married women, and menstruation is generally more or less deranged. But overgrowth, thus apparently excited, by the commencement of uterine life, is quite distinct from a merely functional enlargement of the organ associated with amenorrhœa.

No *treatment* has much control over this condition, either in arresting its progress or promoting its reduction. The preparations of iodine may be tried, and the special medicinal agents with hygienic measures which influence the catamenial function. Amputation has been resorted to in extreme cases, and after the removal of one breast the other has much diminished.

*Hypertrophy* of the *Fat* around the Mammary gland, is occasionally seen; the breast thus attaining possibly to an enormous size. In one such case, which my colleague Dr. Cockle showed me, the fatty breasts of a young woman, aged nineteen, weighed each about eleven pounds. But, the tumour of the fatty breast is evidently *continuous* with the fat *around*; and this is its main diagnostic point of distinction from hypertrophy of the breast itself.

*Treatment* here also is of little avail. Liquor potassæ in large doses, as originally recommended by Sir B. Brodie for fatty tumour, may have some beneficial influence.

ATROPHY, or wasting of the gland-tissue of the breast, commonly takes place as the procreative function ceases in advancing life. The lactiferous ducts remain, and sometimes contain a tenacious mucus. The gland, otherwise, is very generally replaced by fat; thus presenting the outward form of the organ. In extreme atrophy of the breast, as found in old women, the arteries are not uncommonly converted into bony tubes; a degeneration of these vessels, of which specimens may be seen in the Museum of the Royal College of Surgeons, 2811, 2812; and one in Guy's Museum.

Occasionally, in early life, atrophy occurs; the gland not enlarging during pregnancy nor secreting any milk after parturition. Prolonged lactation and its rapid repetition, have an atrophying effect; and sometimes, weaning is followed by shrinking of the gland-tissue, so that scarcely any breast remains; the gland, however, resumes its size and secretory power, even more perfectly than in full-breasted women, during a subsequent pregnancy.

A new growth, as an adenocoele, forming in the breast, is often accompanied with wasting of the organ; and which may thus be almost replaced by the growth.

TUMOURS.—(1) ADENOCELE OR ADENOID TUMOUR.—The Chronic mammary tumour of Sir A. Cooper, Sero-cystic sarcoma of Sir B. Brodie,

and Mammary glandular tumour of Paget. This most common form of breast tumour is encapsuled and finely lobulated; its section has a bluish or greenish-white colour, which assumes a rosy tint on exposure to the air, and pressure of the cut surface exhibits drops of thick creamy fluid, consisting chiefly of epithelium. The tissue of this tumour closely resembles that of the gland itself; of which organ it might therefore be termed a *partial* hypertrophy or overgrowth, but as an encapsuled or *discontinuous* formation, it must be regarded as a new growth.

Two *varieties* of structure—according to Mr. Birkett—may be recognised; *fibrous* adenocoele, consisting of densely compact lactiferous ducts, perhaps containing a milky secretion; and *cystic* adenocoele, the cysts proliferous of glandular tissue from their interior, and containing a yellowish, transparent, serous fluid, afterwards dark and opaque. The cysts may be either a new formation; or result from the dilatation of lactiferous ducts, as Sir B. Brodie originally described their origin in sero-cystic disease of the breast. These two modifications of cystic adenocoele, differ in their origin, rather than structurally.

*Symptoms.*—Adenocoele usually commences as a small, hard, granular, circumscribed, and painless or scarcely tender, nodule or lump; situated upon the cutaneous surface of the breast, or at its border, in its substance, or behind it. When superficial, this lump is isolated and moveable under the skin; but when imbedded or behind the gland, these characters are indistinct or wanting. With an increasing size of the growth, the gland itself becomes atrophied. More than one such lump or many, may possibly be developed, varying in size from half an inch to two or three inches. Both breasts seem equally liable to this affection, and both may be affected, though rarely.

*Cystic* adenocoele is distinguished by fluctuation, more or less perceptible, according to the superficial or deep situation of the growth; this character gradually disappears, as the cyst or cysts become solid, in part or entirely, owing to proliferous growths occupying their cavities more or less completely. The skin stretching over the tumour, usually accommodates itself to increasing distension, without ulceration ensuing; sometimes, however, the skin becomes involved, and a fungoid growth protrudes externally, or a peculiar ulcer is presented, the edges of which are thin and lie flat upon the intra-capsular growth, being neither inverted nor everted, nor adherent thereto.

*Causes.*—No age is exempt from adenocoele; it may commence about puberty, or subsequently, and most frequently at the stage of passive maturity of the breast, between twenty and thirty years of age. Single women seem most liable, and of married women, it occurs more often in those who have borne children; but rarely, during pregnancy. External injury, as a blow, is now and then, apparently, the exciting cause of adenocoele.

*Course and Terminations.*—Adenocoele grows with a varying rate of progress; the originally solid and fibrous form enlarges slowly; the cystic form increases more rapidly; and either variety may attain a large or even enormous size, and a weight of many pounds. The general health remains unaffected, excepting when a fungoid growth reduces it by continued discharge. Sometimes, the tumour remains stationary, and occasionally it disappears. After removal, it seldom reappears; the fibrous variety very rarely, the cystic variety less unfrequently; and youth confers a decided immunity to recurrence, no return having ever been



met with, by Mr. Birkett, when the tumour had originated before thirty years of age. Recurring adenocoele may alternate from fibrous to cystic, and a third tumour return in the fibrous form of growth.

The *diagnosis* of adenoid tumour from other tumours of the breast, must be determined by reference to the *whole* of its pathology; in respect to the characters of the tumour, its causes, course and terminations. The points of distinction between adenoid and cancer of the breast, are most important. They are mainly, the absence generally of any implication of surrounding parts by infiltration; as of the skin, with retraction of the nipple, and ulceration of the integument over the tumour, and never any enlargement of the axillary or other neighbouring lymphatic glands; the general health also remaining unaffected. *Cystic* adenocoele more apparently resembles cystic cancer, and particularly when the growth has advanced to the condition it occasionally assumes, that of a protruding fungoid mass. But here again, the absence of any contamination of the neighbouring lymphatics, and of constitutional cachexia, are the turning points of distinction.

*Treatment.*—*Excision* of the tumour is the only certain cure. An incision is made over the lump, laying open its capsule, and the growth is then easily enucleated with the handle of the scalpel; thus sparing the mammary gland, and possibly without cutting it. The removal of a large tumour may necessitate excision of the gland as well. *Absorption* of an adenoid tumour is a rare event in nature, and but little under the influence of any known local applications or general treatment. The preparations of iodine, in the form of ointment and taken internally, have been recommended, as having some effect; and compression by means of Arnott's slack-air cushion, is said to have proved especially serviceable, in promoting absorption.

(2) **FIBROUS TUMOUR** of the breast is described by some authors, and also its *recurring fibroid* variety. Both these growths are rare. Probably, some such tumours have been fibrous adenocoele. Their pathology and treatment by excision, require no special notice.

*Neuroma* is occasionally developed on the cutaneous nerve-filaments, or on those within the substance of the breast. It, also, presents nothing peculiar in connexion with this particular organ, whether as to its pathology or removal by operation.

(3) **FATTY TUMOUR**, as a new growth, has been found on the breast, within the gland, or behind it; a condition distinct from fatty hypertrophy of the breast, which is simply an overgrowth of the fat surrounding the gland. The diagnosis will always be difficult, but removal of the mass is the only cure.

Remarkable cases are recorded; Sir A. Cooper removed a tumour of more than fourteen pounds weight, Sir B. Brodie relates another case in his Lectures on Pathology and Surgery, Warren excised a tumour of eight pounds, and Mr. Roper of Croydon, sent to the Museum of Guy's Hospital (prep. 2300<sup>50</sup>), a fatty tumour, measuring twenty-three inches around its largest circumference, which had been growing in the side of the mammary gland for fifty-eight years; it was first noticed by the woman in her thirtieth year, and she died with it at the age of eighty-seven years. In the centre of the mass there was an irregularly-shaped piece of bone.

(4) **CARTILAGINOUS, and OSTEOID TUMOURS** are extremely uncommon. Their firm, lobulated character, is similar to that of such tumours in other parts; and the treatment is excision.

Sir A. Cooper relates an instance of tumour, partly resembling the cartilage of a young subject, and partly ossific, which had been growing in the breast of a woman for fourteen years; her age being thirty-two. Professor J. Müller also notices an instance of cartilaginous tumour in the mammary gland; while he adds three other cases of this species of growth, in one the parotid gland was the seat, and in two, the testicle.

(5) **CRSTS, and CYSTIC-TUMOURS.**—Cysts—single or unilocular, and multiple or compound, and having various fluid or solid contents, as proliferous cysts—are severally liable to form in the mammary gland; or they may be associated with, and embedded in, other species of new growth, constituting cystic tumours, and of different kinds, as cystic adenocoele and cystic cancers.

The origin of these cysts, and their contents, are the principal grounds of pathological distinction.

(a) *Sero-cysts.*—Single or multiple, thin-walled, and containing a clear, colourless or pale yellow tinted fluid, of serous character and never tenacious. No coagulation is caused either by heat or nitric acid. These cysts originate either as new formations, or possibly from dilatation of lactiferous ducts, with which they may communicate or appear as perfectly closed and independent cysts.

(b) *Duct-cysts,*—perfectly closed or communicating with a duct, and containing mucoid secretion; hence named also, *mucous* cysts of the breast.

(c) *Galactocoele* or *milk-cysts,*—produced by dilatation of a lactiferous duct or its sinus from obstruction, or by rupture of the duct, and escape of the milk into the surrounding connective tissue. A cyst-formation incident to suckling, and occurring, therefore, only during the period of lactation; it is rather a rare affection. The little tumour—presenting sometimes as an oblong fluctuating tube, near the nipple, may enlarge perceptibly every time the infant sucks, and thus increase rapidly; or it may remain almost stationary. The serum of the milk accumulated, undergoes absorption, while the more solid fatty matter and earthy salts are deposited; causing the swelling to decrease and become firmer or quite hard, unlike a cyst wall, or the deposit may take the form of a lacteal calculus.

(d) *Hydatid cysts*—are occasionally met with in the breast. Mr. Birkett verified two such cases; one in the practice of Mr. B. Cooper, and the other in that of Mr. Cooper Forster.

**SYMPTOMS.**—Certain characters are common to all cysts, and cystic tumours in the breast. A *single* cyst presents a globular tumour, having an elastic tension or fluctuation; more or less perceptible according to the superficial or deep situation of the cyst, and the thickness of its walls. *Multiple* or compound cysts present an irregularly lobulated tumour, otherwise having the consistence of a single cyst. *Cystic-tumour* resembles either of these conditions; in proportion to the cystic nature of the tumour; but associated also with a solid mass, bedding or enclosing the cyst or cysts.

Cysts are not essentially painful; they may become tender, owing to inflammatory action, or in nervous subjects. The skin is unaffected, excepting in the fungating tumour of proliferous cysts; and then, the neighbouring lymphatic glands remain uncontaminated, and the general health is unimpaired by any cachectic blood-condition. By these two particulars at least, cysts and cystic tumours, in common with all other

non-malignant growths, are distinguished from Cancer. In all doubtful cases, and many will be dubious, the diagnosis should be determined by an exploring puncture and examination of the exuded cyst-contents, before resorting to any curative operation.

**TREATMENT.**—*Absorption* of the contents of a cyst can sometimes be effected by the mere application of stimulating embrocations. Thus, Sir B. Brodie recommends, as having proved successful, a lotion consisting of equal parts of camphorated spirit and weak spirit, with about one-third of *Liquor plumbi*. This must be applied on a piece of flannel, once folded, over the tumour, and renewed six or eight times in the day and night until the skin becomes inflamed; then desisting for two or three days, and again using it. Three or four weeks or some months elapse before a cure is thus effected. On the same principle, iodine paint or blistering may be curative. *Puncturing* the cyst, followed by pressure, may obliterate the cavity by adhesive inflammation; or the introduction of a tent of lint will induce suppuration, and granulation from the bottom. *Excision*, by carefully dissecting out the cyst, is not unfrequently the best or only method of treatment; or it may be necessary to remove the gland, partially or wholly. Partial excision of the gland is apt to favour a recurrence of the cystic growth, in the remaining portion of the organ; but its entire removal is, occasionally, succeeded by cystic disease, or perhaps a cancerous affection of the cicatrix.

(6) **CANCER.**—The breast is peculiarly liable to be the seat of primary cancer: scirrhus, very commonly; encephaloid occasionally; colloid, rarely.

The disease appears, either in the form of an infiltrating growth, or as a circumscribed or tuberos growth; or, it may be cystiform, associated with a cyst or cysts.

*Scirrhus.*—The descriptions usually given in surgical works of the pathology and diagnostic characters of Scirrhus Cancer, are mainly taken from scirrhus of the breast, it being the most typical illustration of this species of Cancer. As such, the general pathology of Cancer may be advantageously referred to, in Part I.; while the more specially important features only of the disease, as affecting the breast, will here be noticed.

It may appear in the form of an intra-mammary tumour, or as infiltrating the whole organ, or upon its surface or circumference; or as affecting the nipple, or the skin. Commencing, commonly, as a *circumscribed* tumour, or lump, of small size, about that of a Spanish nut, hard and moveable: it occasions little or no pain and may remain unnoticed. Increasing in size slowly, this nodule acquires a granular or finely lobulated character, and is more fixed. Scirrhus *infiltration* of the gland commences as a diffused mass, and often of a somewhat square shape; hard and irregular, and soon contracting adhesions, it becomes fixed. Atrophy of the glandular structure sometimes accompanies the development of the cancer.

*Cysts* are liable to form in connexion with the scirrhus growth, constituting a cystic cancerous tumour; which is thus more irregularly lobulated, and partly solid, partly fluctuating more or less perceptibly, under pressure with the fingers.

The surrounding parts become involved, and the tumour is the seat of severe pain, variously described by patients, as shooting, stabbing.



burning, &c. The gland acquires adhesion to the pectoral muscle, and to the skin over the tumour, the integument being bound down and presenting a dimpling or puckering, or having a brawny character, and a glazed or greasy appearance with the pores enlarged; the nipple is often drawn in by the adherent and contracting gland,—presenting the appearance of retracted nipple. But this condition is not peculiar to cancer. Reddish brown discoloration of the integument, at some tightly adherent part, is followed by the formation of a crack or fissure, which scabs over, while ulceration proceeds underneath the scab. A scirrhus ulcer is at length formed, having the ordinary characteristic appearances; hard, thickened, and everted edges, around an irregular chasm, the surface of which has a grayish-green colour, and discharges foul purulent matter. This ulcer may remain nearly stationary for months or years; or increase rapidly by sloughing; or throw up large fungous granulations and undergo an imperfect cicatrization. But, the progress of the disease, thus hesitating and interrupted, goes on. The axillary lymphatic glands sooner or later become enlarged and indurated, or assume the form of an agglomerated bunch, itself also adherent, and which undergoes the further course of breast-cancer. In an advanced and extreme condition, the mammary gland and axillary glands become almost one continuous matted and adherent mass, extending through the cellular texture, connecting lymphatics, and skin of the breast and axilla; forming a sort of cuirass,—the cancer *en cuirass*, of French authors, and which is accompanied with much œdema of the arm. The supra-clavicular and cervical glands may also be implicated.

During the course of the disease, constitutional cachexia sets in, usually when the cancer begins to acquire adhesions, particularly to the skin; and both the local and constitutional infection may then proceed almost *pari passu*.

The deeper parts, and remote organs, may ultimately become the seat of *secondary* cancer. The ribs and intercostal muscles are affected more by the direct infiltration of cancer, giving rise to pleurisy, dyspnœa, and hydrothorax; but cancer may appear in the bones and result in fracture, or in the liver or uterus, and possibly escape detection during life. Exhaustion, consequent on prolonged discharge and the constitutional infection, is perhaps, the most frequent cause of death.

Scirrhus commencing in the *skin* of the breast, appears in the nipple, or as a tubercle, situated usually towards the axillary border of the breast. Spreading inwards to the gland, the course of the disease is the same, but it probably will have a more restricted range.

*Encephaloid* begins either in the substance of the gland, or occasionally, in the immediate neighbourhood. It appears as a circumscribed, globular tumour, of soft consistence, rather largely lobulated, and rapidly increasing in size. The skin is distended before the enlarging growth, and does not so readily become adherent, but presents a largely open network of veins. By its physical characters, the tumour might be mistaken for compound cysts; in that case, however, the skin retains a passive appearance. Sometimes the integument soon becomes inflamed and œdematous, and then the tumour simulates the characters of an abscess. But the breast rapidly undergoes a remarkable change of form, becoming conical and prominent; and the integument over the most projecting part assuming a purple hue, sloughs and forms a circular ulcer, through which the encephaloid growth protrudes as a fungoid mass, of a

grayish or bloody colour, accompanied with a foul, purulent and bloody discharge. Portions of this mass disintegrating and separating, further protrusion from within takes place, and still maintains the fungous mass; but rarely, the whole tumour thus sloughs out, and cicatrization ensues. The lymphatic glands are involved, although less readily than in scirrhus of the breast; and the constitutional cachexy is less marked, or absent.

*Colloid*.—This rare form of cancer of the breast, consisting of gelatinous substance, loculated by a delicate fibrous matrix, presents a tumour of a somewhat tense and elastic character,—not very distinctive. Mr. Erichsen removed one such tumour from the breast; it was non-adherent, and had attained the weight of six pounds, after growing for five years. Mr. Birkett has seen two examples, in both of which the nature of the tumour could not be identified, when in the breast. Isolated centres of the growth are disseminated freely around the principal mass, an important pathological condition with reference to the operation of excision for complete removal of the tumour.

This species of cancer is usually associated with scirrhus or encephaloid.

The *causative* relation of age and uterine activity to cancer of the breast, is diagnostically important. From the fortieth to the fiftieth year, or the fifth decade of life, is the age most liable to this disease, as affecting the breast. Of 158 cases collected by Paget and 62 by Lebert, the disease appeared in 22 only before thirty years of age. Before twenty years of age, Mr. Birkett has never seen a case. But Mr. Lyford and Mr. B. Cooper, each record one instance; the one at eight years, the other at thirteen years of age; and in the Museum of St. Bartholomew's Hospital there is a specimen removed from a girl aged sixteen years.

The following interesting Table gives the results of Mr. Birkett's experience in 458 cases, between the ages of 20 and 100 years, in decennial periods:—

Age from 20 to 30 years	19 cases.
" 30 " 40	100 "
" 40 " 50	193 "
" 50 " 60	97 "
" 60 " 70	34 "
" 70 " 80	6 "
" 80 " 90	7 "
" 90 " 100	2 "
	<hr/> 458 "

Unmarried women are said to be more prone to cancer of the breast than the married, and sterile women rather than those who are prolific. The fallacy of these notions is shown by Mr. Birkett by an analysis of 100 cases; 86 were married, and 14 only, single. Of the 86 married women, 73 were prolific, 4 had aborted, and 9 only were sterile. In relation to lactation, there does not seem to be any marked connexion between the imperfect performance of this function and the subsequent development of cancer; but it is a notable fact, that the disease is very rarely developed during pregnancy or suckling.

The origin of the disease is popularly attributed to some external injury, as a blow, or the pressure of a stay-bone; there is abundant

evidence to justify this belief, and that any injury to the breast, however slight in itself, may be the exciting cause of cancer-production.

*Prognosis.*—The average duration of life is about three years, or less than four; and scirrhus is less rapid in its course than encephaloid; the rare form, colloid, growing slowly. Scirrhus also proceeds more slowly in old people; there are many instances where the disease has existed for ten or twelve years, and in one instance, as related by Sir B. Brodie, for twenty-five years. Encephaloid proceeds most rapidly in young, and constitutionally healthy women. Generally, it may be stated; that the younger and more healthy the patient, and rapid the course of the disease, the prognosis is proportionately unfavourable.

*Treatment.*—The hygienic and medicinal treatment of cancer of the breast, and its removal by operation,—whether by excision or some other method, are two principles of treatment; each of which has its advocates, and to the exclusion of the other and opposite principle. Some Surgeons would treat all cases medicinally, and according to the natural course of the disease; others would, in all cases, extirpate the disease by operation. It is unnecessary to point to illustrations of these opposite views in the practice of Surgeons, present or past.

The truth, as in many other matters, lies between these two extreme rules of treatment. The intermediate plan has reference to the individual case, both with regard to the local condition of the cancer and the constitutional power of the patient.

Assuming a case to be thus ineligible for operation, the following plan of treatment should be pursued. The disease being a perversion of nutrition as manifested by a reproductive growth, the *pathological* and rational indication of treatment remedially, would be; to rectify this deviation of the nutritive process so as to arrest the growth of cancer, and possibly lead to a predominance of the reverse process,—absorption, and thence the eventual disappearance of the tumour. Any such control over the formative or vital changes in nutrition, or over the chemical changes of the nutritive material—any such mode of arresting cancer growth, is quite beyond our present knowledge of physiology and pathology, in respect to this process. It only remains, therefore, for the practitioner to avail himself of such knowledge as *experience* has supplied. A generally nutritious diet, as the phrase goes, will suggest the object to be attained, in the selection of dietetic resources; but it is absolutely necessary to watch and discover, in each case, what particular articles of diet are most suitable for the improvement of the patient's general nutrition, and may have any marked influence on the progress of the disease. Anodynes, applied topically and administered internally, not only relieve the often severe and prolonged suffering incident to this disease; but these medicinal agents are important adjuncts to our dietetic resources, in procuring sleep and repose of the nervous system, requisite for a more healthy nutrition. Thus, narcotics, and in particular the preparations of opium are highly advantageous; while conium-ointment is I think, the most soothing topical anodyne, although aconitine ointment or belladonna plaster may be equally so in some cases. The preparations of ether,—sulphuric and chloric, and chlorodyne, are most efficacious for the relief of paroxysmal pains of a neuralgic character; and here quinine and iron are serviceable, as tonics. But tonics have probably a yet deeper remedial value. Iron may have some restorative influence in proportion to the cachexia, which plainly denotes a morbid-blood condition, one element of



which is a diminution of the red-corpuscles. Quinine is remedial in sustaining the general circulation, and thus supplying the pabulum of an improved assimilation; while stomachic tonics, such as gentian, calumba, and humulus lupulus, aid the digestion or primary assimilation of food.

Thus then, there is apparently a running connexion between these known measures,—a nourishing, well-selected diet, anodynes, and tonics, and they constitute the principal resources of the hygienic and medicinal plan of treatment, in respect to Cancer. By combined observation and judgment in the application of this plan, and by pursuing it perseveringly, doubtless many cases of scirrhus of the breast have been kept in abeyance—and life prolonged far beyond the average period of duration in this form of Cancer-growth.

*Compression* has been extolled as having an almost or absolutely a curative efficacy. Various means have been employed; the slack air-cushion of Dr. Arnott, or plasters, which besides supporting the tumour may have some medicinal influence in arresting its growth. But the pretensions of this method are, I believe, now renounced, and indeed any such applications are generally discarded. The arrest of a reproductive growth, as cancer, is not to be accomplished simply by mechanical repression of the tumour,—nor in the face of its inherent power of growth, can the tumour be made to undergo absorption. Any apparently successful results of this principle of treatment have been altogether exceptional; and probably, therefore, were due to other concurrent causes of cure.

*Ulcerated cancer* must be treated as any other open sore, according to its varying condition. Sloughing should be met by poultices, and cleansing lotions of chloride of zinc, permanganate of potash, or carbolic acid; in conjunction with sedatives, such as morphia, conium or belladonna to allay pain. Hæmorrhage may be restrained by the ice-bag temporarily applied, or by means of astringent powders or lotions, such as tannin or tincture of the perchloride of iron. *Edema* of the arm, in the advanced stage of the disease, can be somewhat relieved by moderate bandaging and elevation of the limb.

*Conditions favourable for operation.*—In proportion to the purely local and isolated condition of the cancer; its removal is justifiable, or favourable—in relation to the prolongation of life. This local state carries with it a proportionate share of constitutional power. Hence, in the early stage of cancer, when it is as yet small, and moveable; without adhesions, or implications of surrounding parts,—either in the integument by adhesion or ulceration, or the lymphatic glands by enlargement and induration; and consequently when there is little or no constitutional cachexia; the breast may be removed with the *most* favourable prospect of prolonging life. Mr. Birkett extends this principle to some degree of advancement in the progress of the disease; as even then offering an advantage, compared with allowing it to run its course. That, therefore, an operation may be undertaken with advantage when the disease has extended to the skin without infiltrating the cutaneous tissue to a wide extent, when ulceration has taken place, and even when the axillary lymphatic glands are distinctly indurated and somewhat enlarged.

*The probability of cancer recurring in situ*, after removal of the original growth, by operation.—The statistics respecting this question are unreliable, whether as to the proportion of recurrent cases, or as to the average period of immunity, before the return takes place. But, experience shows that in a large proportion of cases, the disease returns;

generally also, in two or three years, as Sir A. Cooper and Sir B. Brodie both observed, and with a fatal termination.

*The probability of prolonging life, by operation*—The statistics collected by Paget and Sibley, respectively, are here to the point. Paget states, that of 139 cases, 75 were not submitted to operation, and of these the average duration of life was 48 months. Of 64 operated on, the corresponding average was a little beyond 52 months. But the *period of the disease*, when submitted to operation, makes a very important difference in its result. Thus, in the first two years of the disease, the proportion of deaths was much less in those operated on than in those who were left to nature and other treatment; being in the former less than 11 per cent.; in the latter more than 30 per cent. The longest duration of life in cases not operated on, was 18 years; in those operated on, a little beyond 12 years. Sibley finds that the average duration of life in unoperated cases was about 32 months; whilst in those submitted to excision of the breast, it reached 54 months. The *temporary relief* from suffering should, however, always be taken into account in considering the advisability of operation.

The *comparative advantages of excision*, and removal by *caustic* applications, may be thus summarily stated. The one method is expeditious, attended with little suffering, and certain of removing the whole of the diseased organ; if the operation be performed sufficiently free of the disease. The treatment by caustics is tedious, attended generally with excruciating pain, and very uncertain in its operation. In comparing the results of the two methods upon the constitutional progress or local recurrence of the disease, there is not a balance of evidence in favour of either. Both are commonly followed by a return of cancer *in situ*, or its development in distant parts. The mortality after amputation of the breast, as referable to the *operation* itself, is extremely small, not exceeding 6 per cent. or much less.

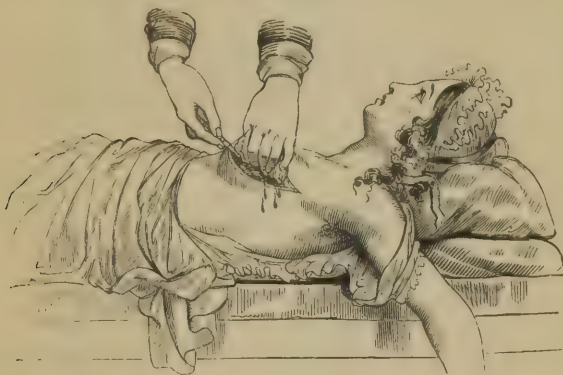
*Recurrent cancer of the breast*.—Cancer may return in the cicatrix, and subsequently implicate the glands; or in the glands without any previous affection of the cicatrix. *Cicatricial* scirrhus presents itself in the form of scattered tubercles or buttons of cancer-growth; a very characteristic appearance. The period of recurrence is uncertain; sometimes before cicatrization is completed, and having the character of a cancerous ulcer; or not until after some weeks or months of completed cicatrization, then having the tubercular form in and around the cicatrix, and the nodular growths undergoing cancerous ulceration. Recurrent cancer often runs its course more rapidly than the original growth, but it is said to be less painful and exhaustive.

The operation of excision is still justifiable, even to the third or fourth reappearance of cancer, in order to relieve suffering; provided the constitutional power of the patient seem sufficient to sustain life. I thus removed with some advantage a large tubercular cancerous cicatrix, and subsequently the whole of the axillary glands in a bunch, from a lady, whose breast I had previously completely excised; but after she had again enjoyed a temporary respite, the disease returned a second time, in the form of a nodular shield over the pectoral muscle, and when last I heard of her she was in a dying state.

*OPERATION OF AMPUTATION OF THE BREAST*.—Whatever may be the disease, whether a cancerous or non-malignant tumour; removal of the breast is performed in the following manner. The patient lying down,

and chloroform having been administered; an assistant holds the arm away from the affected breast, sufficiently to put the pectoralis muscle on the stretch, and define the breast on its axillary border. The Surgeon introduces a breast-knife on the axillary aspect of the breast, and makes a semi-elliptical incision below the nipple, varying in its extent according to the size of the tumour; this incision is made first, that its course shall not be obscured by blood trickling down from above. A corresponding incision is then made above the nipple, thus including the nipple and an elliptical portion of integument. The portion removed is small compared with the size of the tumour, but the integument remaining as a bag after operation, contracts eventually so as not to be superfluous. The breast is then dissected out from below upwards, the knife being carried slopingly around the organ down to the fibres of the pectoralis, along the axillary aspect of this muscle, and thence upwards under the tumour, to meet the upper incision. (Fig. 396.) Care should be taken not to make a button-

FIG. 396.



hole in the skin; a blemish which may be avoided by directing the edge of the knife towards the tumour, in detaching it from the integument, below and above.

A *cancerous* breast must be removed more extensively than when it is the seat of non-malignant tumour. The incisions should be carried so as to include any apparently affected portion of integument; and prolonged upwards towards the axilla when necessary, to allow the removal of any affected glands. In removing the tumour, the dissection should be carried wide of the disease and fairly into apparently sound tissue around, in order to completely extirpate the diseased mass. It may be more convenient in concluding the operation, to extend the axillary junction of the incisions, so as to reach any diseased glands; their connexion with the breast will enable the Surgeon to drag them out of the axilla, when they can be readily detached by successive touches with the knife. If the glands be removed after the breast, they may be seized with artery-forceps or a vulsellum, and dissected out. The operation-wound should be carefully examined, to see that no part of the gland or affected portion of cellular texture remain behind.

Arteries bleeding must be tied or twisted; they are principally situated towards the axillary aspect of the wound. If the tumour removed be non-malignant, only one or two vessels may have to be secured;



removal of a malignant tumour will probably necessitate the ligature or torsion of numerous and large-sized arterial branches, which are supplied to this more active form of growth; and venous hæmorrhage may require control. Cold ablution will generally arrest any oozing hæmorrhage, arterial or venous. The lips of the wound should then be brought together by a few points of suture; and the support of two or three strips of plaster with a compress of lint and a bandage, will prevent any subcutaneous hæmorrhage and bagging in the loose integument. Primary union sometimes takes place, and in a few days; but more frequently this union is spurious, and the wound opens up partially at least, with suppuration, and heals by granulation. Secondary hæmorrhage may necessitate a re-opening of the wound, and the application of ligatures. Eventually a sound, puckered cicatrix is presented; or perhaps a recurrent form of growth, when the original tumour was malignant.

FUNCTIONAL DISORDERS OF THE BREAST.—(1) *Abnormal secretion of milk*.—This disorder relates to the age of the woman and is also unassociated with pregnancy. The breasts of old women have been known to secrete milk; and it has formed at a very early age,—eight years. In some women, reputed virgins, the breasts have secreted a troublesome quantity of milk; and I have seen the lacteal secretion excited in a woman nearly fifty years of age, after sexual intercourse; she having borne eleven children.

(2) *Excessive lacteal secretion*—or *Galactorrhœa*.—The milk may be constantly dribbling away; or the secretion may continue after weaning suddenly, or at the termination of a proper period. This undue secretion is suppressed most effectually by the application of the extract of belladonna, spread thickly on lint, and placed over the whole breast or both breasts. Sedatives and tonics have also some degree of beneficial influence in arresting the secretion.

(3) *Deficient lacteal secretion*—or *Agalactia*—depends, either upon an organic imperfection of the gland, or on constitutional causes. The secretion will probably be excited by the application of the leaves of the castor-oil plant to the breast, by warmth and moisture, and by the stimulus of the act of suckling.

(4) *Congestion with Milk*.—This state seems to depend on a secretion of the more solid constituents of the milk, without the serous; thus favouring an accumulation of thick milk in the lactiferous duct, instead of the escape of the secretion being facilitated by a due admixture of fluid. The breast acquires an enormous size, and a stony hardness, resembling scirrhus. But the sudden appearance of this large tumour, and its occurrence during lactation, probably when this function first commences after parturition; are sufficiently diagnostic.

Lacteal congestion of the breast proceeds very slowly, and generally terminates in inflammation and abscess.

This affection is usually confined to one breast; and the gland having regained a healthy condition, performs its function healthily after a subsequent parturition.

The *treatment* consists in strapping, and the application of an ointment of iodide of potassium or iodide of lead; gentle aperients and tonics.

DISEASES OF THE MALE BREAST.—The mammary gland in the male exists in a rudimentary state; occasionally only some development of glandular structure taking place. Soon after birth, the organ becomes

tumid, and a slight secretion forms within the ducts. This naturally ceases, or may require repressive treatment. At puberty, the gland again enlarges, is painful for a few days, and then subsides. Irritation at this time may induce inflammation and abscess.

*Hypertrophy* of one or both breasts sometimes occurs in men of delicate constitution; the glands enlarging sufficiently to resemble the bosoms of young girls. *Treatment* of any such natural conformation will scarcely succeed in reducing this annoyance.

*Tumours*, of the same species as those in the female breast, occasionally form in the male breast. Cancer is the most frequent growth, and it occurs generally between forty and fifty years of age. The *treatment* of morbid growths presents nothing peculiar. Amputation of the breast is performed in the same way as for the removal of the female breast, but the operation in the male is less extensive.

ANOMALIES OF DEVELOPMENT, IN THE FEMALE AND THE MALE BREAST.—

(1) *Absence* of the Breast is recorded both by Sir A. Cooper and Froriep. Congenital deficiency of the Nipple has also been met with.

(2) Supernumerary Breasts are of more frequent occurrence, though rare. Most frequently, one supernumerary gland has been found; sometimes, two such glands; rarely, three; constituting, with the normal glands, five mammae. The situations of an abnormal mamma are remarkable; usually contiguous to the natural breast, and where four breasts have been developed, they have ranged in parallel pairs, one above the other on either side of the thorax. But an extra breast has been found in the axilla, on the back, on the abdomen, in the groin, or on the outer part of the thigh. These glands, thus oddly situated, have been known to secrete milk. Supernumerary *Nipples* also sometimes occur; two to each natural breast, both nipples communicating with the gland and passing milk. Several extra nipples have been developed on one breast.

The *male* breast is liable to similar developmental anomalies. Thus, four nipples have been seen. Deficiency of one or both nipples seems to be unknown.

## THE ABDOMEN.

### CHAPTER LI.

#### INJURIES OF ABDOMINAL PARIETES, AND VISCERA.

INJURIES of the Abdomen are of almost equal concern to the Civil and Military Surgeon. Their leading practical distinctions are as follow.

CONTUSION OF THE ABDOMINAL PARIETES.—The extent of structural disorganization produced by contusion varies considerably; the abdominal muscles being lacerated possibly, while the skin remains unbroken. The ordinary appearances of Bruise are presented, in most cases, and the usual symptoms of shock in a greater or less degree.

The *cause* of contusion may be various occasions of external violence—such as a blow or kick. Shock may either soon prove fatal or pass off;

and the bruise may gradually disappear, or be succeeded by abscess, or by peritonitis and thence a fatal termination. After recovery, the abdominal wall sometimes becomes atrophied at the seat of injury, predisposing to the occurrence of ventral hernia.

The *treatment* has reference to the recovery from Shock, by a moderate administration of stimulants; followed by the ordinary topical applications to a bruised part, coupled with rest.

*Wounds* of the Abdominal Walls, differ in no particular from the same injuries elsewhere, and the treatment must be conducted on ordinary principles.

*Abscess* sometimes forms in the abdominal parietes, and may spread extensively. It arises usually from contusion or other injury; but I have seen wide-spread parietal suppuration proceed from the irritation of a foreign body—a bean, impacted in the vermiform appendix of the cæcum, which lay in contact with the abdominal wall, apparently as a spontaneous effort of elimination. Carbuncular abscess also I have known to occur in the abdominal wall. *Treatment* of abscess in this situation presents nothing peculiar.

**INJURIES IMPLICATING THE ABDOMINAL VISCERA.**—The *general symptoms* of any such injury are those of Shock—severe and prolonged, coupled with the collapse arising from internal hæmorrhage. The pallidity of countenance and anxious expression, the coldness of surface, and thready feeble pulse, are sufficiently characteristic symptoms. With extensive internal hæmorrhage there may be perceptible dulness on percussion.

*Special* symptoms proceed from injury of different abdominal viscera; they are somewhat diagnostic of the organ implicated, but depend also on the causes of such injury.

The *causes* in question, are rupture from contusion, and penetrating wounds of the abdomen. *Contusion* is necessarily occasioned by severe external violence; the passage of a cart-wheel across the abdomen, or compression between the buffers of two railway carriages, known as Buffer-accidents; and in Military Practice, the brushing action of a wind contusion, or the direct pounding of a spent cannon-ball. Rupture of any one of the viscera, and extensive internal hæmorrhage, are not necessarily attended with any mark of contusion or bruise, as an outward sign of this internal injury. An abundant layer of fat in the abdominal wall, combined with thick clothing, seem to form a buffer of yielding resistance, which may prevent the production of a bruise. In one such case, a stout female, who had been brutally kicked in the abdomen by her paramour, died in a few hours from collapse. I found a large collection of black clotted blood in the abdominal cavity, but not a trace of discoloration in the integument. *Penetrating Wounds* are commonly produced by a stab, or a pitchfork accident; and in Military Practice, by a sword-cut or bayonet-thrust.

*Rupture, or Penetrating Wound, of Different Viscera.*—*The stomach.*—The diagnostic symptoms are; vomiting of blood, with perhaps the escape of some of the contents of the stomach in the case of a wound. But the stomach has been *ruptured*, almost completely across near the pylorus, and no blood appeared in the vomited matters. The situation and depth of a *wound* will help to determine the diagnosis.

*The Bowels.*—Similar symptoms are diagnostic; the passage of blood in the stools, and the escape of fæcal matter through a wound. Extravasation of fæcal matter into the abdominal cavity is attended with instant,



excruciating pain, radiating over the whole abdomen from the seat of injury, and extreme collapse. But a small wound of the intestine may not allow of extravasation; the mucous membrane protruding through the muscular coat and occluding the aperture, while the equable pressure of the abdominal viscera against each other prevents any escape from an intervening wound. Subsequently, the speedy effusion of plastic lymph tends to close the aperture. The absence of the characteristic pain and collapse—as symptoms of feculent extravasation, is, therefore, no conclusive evidence that the bowel is neither ruptured nor wounded. Emphysema of the abdominal wall may arise from the escape of flatus through an intestinal aperture, into the sub-peritoneal cellular tissue. Commencing, usually, in one or the other flank, the peculiar, pitting, crepitating swelling extends forwards around the abdominal parietes, and upwards towards the axilla. This symptom is the result alike of rupture or wound.

*Liver.*—Owing to the highly vascular nature of this organ, rupture or wound of its substance is attended with copious hæmorrhage, and proportionate collapse. A bilious discharge distinguishes wound of the liver. Recovery from either injury has been known to occur in some cases; but followed by peritonitis, jaundice, or, as Bernard has shown, saccharine diabetes. The *gall-bladder* alone may be the seat of injury, and rupture or wound seems to have been almost always fatal.

The *spleen*—a fragile and highly vascular organ—is perhaps equally liable with the liver to rupture, and wound may occur; either form of injury is attended with severe internal hæmorrhage and collapse, and both are proportionately fatal.

The *kidneys* are liable to rupture or wound. Frequent micturition of bloody urine is the diagnostic symptom; although the secretion of urine may be suppressed by complete structural disorganization of the kidney, and thus, the absence of this symptom is no assurance that the kidney is uninjured. The escape of urine through a wound will at once indicate the nature of this injury. Any injury to the kidney may induce nephritis.

The *Diaphragm* is most frequently ruptured in connexion with other organs; it may also be penetrated by a stab-wound, by gunshot injury, or by a fractured rib without any external wound. The visceral complication is the fatal element in these diaphragmatic injuries. Hernial protrusion of the abdominal viscera into the thoracic cavity may take place; or occlusion of the gap by the formation of a false membrane is a possibly reparative issue.

*Penetrating Wounds, not involving any viscus*—are distinguished simply by the absence of any symptoms of visceral complication. The escape of a small quantity of reddish serous fluid is the only positive diagnostic sign. Gentle examination with the finger will best and most safely ascertain the fact of penetration.

*Protrusion of Viscera*—and *with Wound of Viscera*.—The former condition is a visceral implication of dangerous character, the latter condition is positively perilous. Both owe their vital significance to the great risk of peritonitis; any extravasation of blood or the contents of certain viscera, increasing this liability.

Protrusion of the stomach, intestine, mesentery, or omentum, may be recognised by the appearances of the protruded mass. Its size is always large as compared with the aperture from which it emerges; and the margin of the opening constricting the protruded portion of viscus, a neck

or peduncle is formed, which is overlaid and concealed by the mass. The aperture and peduncle can be easily discovered by gently raising the protrusion with the fingers. At first, of a bright red colour and glistening peritoneal aspect, the mass soon becomes dull-looking and purple from congestion, and afterwards black and flaccid, as gangrene supervenes.

Wound of a protruded intestine is denoted by the escape of fecal matter and flatus; the characters of the wound also are peculiar, and vary according to its size. A puncture, or an incision two or three lines in length, is attended with eversion or prolapsus of the mucous membrane; which, closing the aperture, prevents the escape of feculent matter. An incision beyond four lines in length, evinces some tendency to protrusion of the mucous membrane in the form of a lip over the margin of the cut; but thus allowing the discharge of feculent matter.

*Consequences, and Prognosis.*—All Injuries of the Abdomen implicating the viscera, whether by Rupture or Wound, are liable, in some degree, to be followed by Peritonitis. Penetrating Wounds of the abdominal cavity have also this liability. But if implicating the stomach or intestine, in particular, the risk is greater; and if attended with the escape of the contents of these viscera into the peritoneal cavity, the danger reaches its maximum. On the other hand, all such injuries have a notable tendency to reparation, by primary adhesive union, and without the extravasation of intestinal or other matter. Certain remarkable cases of such reparation are on record. Thus, John Bell refers to the case of an extensive lacerated opening of the abdomen, in the person of a peasant boy who had been gored by a bull. The intestines—unwounded—protruded, and were replaced. The poor lad came the next day on foot three miles from his village, carrying in the skirts of his shirt and in his hands, a great bundle of intestines which had again protruded; they were again returned, the wound was neatly sewed, and recovery ensued. A madman stabbed himself with eighteen deep wounds in the abdomen, with a long and sharp-pointed knife; eight of the wounds penetrated the cavity of the abdomen, and touched the stomach and intestines, as shown by the vomiting of blood and its passage by stool. Yet the man entirely recovered in two short months. In another paroxysm of madness, eighteen months after this recovery, he threw himself from a high window and died upon the spot. Post-mortem examination revealed the important series of facts;—that, the liver, having been wounded, had adhered in its middle lobe to the inner surface of the peritoneum; the jejunum having been wounded, just below the stomach by an incision half an inch in length, across the gut, this portion of intestine lying deep was not pressed against the inner surface of the abdomen but remained in close contact with a contiguous turn of the jejunum—the two turns of intestine had adhered together, one showing the scar of the wound, the other being untouched; the right side of the colon, wounded by an incision an inch long, had united and adhered to the inner surface of the peritoneum by about a score of long thread-like tags of false membrane, issuing from the inner surface of one of the largest scars in the abdomen.

*TREATMENT.*—*Rupture* of any abdominal viscus—without wound of the abdominal wall, presents only two indications of treatment; restoration from collapse; and the restriction of extravasation, whether of blood or feculent matter, in order to prevent the supervention of Peritonitis. The one indication may be fulfilled by a judicious administration of stimulants, with other measures to induce reaction; the other may perhaps be ac-

complished by rest and sedatives. Opium in grain doses, or the liquor opii sedativus should be given every four hours, so as to keep the patient under its influence, hydrocyanic acid and potash to allay sickness; while the diet must be restricted to spoonful of cold beef-tea, with barley-water and ice, and no aperient medicine given for some days. A mild enema of gruel and castor oil will then be advisable.

*Penetrating wound of the Abdomen*,—not involving any viscus, should be closed in the ordinary manner of a wound in a loose and moveable part. A few points of suture must be used to steady the edges of the integument in apposition, aided by a suitable position to relax the abdominal muscles; but the precaution of a compress and bandage will be requisite as a support, to prevent the risk of visceral protrusion.

*Protrusion of any viscus*, commonly a portion of intestine or omentum, must be met by early reduction, before signs of strangulation have supervened. Relaxation of the abdominal muscles by position, and gentle manipulative pressure, is the rule to be observed. Pedunculated constriction of the protruded mass, should be overcome by slightly enlarging the aperture with a probe-pointed bistoury or hernia-knife. In returning the part, the direction of pressure should be towards the abdominal cavity through the aperture; lest, otherwise, the protrusion be slipped between the muscles, leaving the neck unreduced. Having entirely returned the part into the abdomen, the finger should not follow it further; the gut or omentum may remain more safely placed near the aperture, than in the event of sloughing there shall be a free vent for the discharge. An inflamed state of the protrusion does not contra-indicate its reduction; but gangrene of the intestine must be treated on a different principle,—an incision to discharge the contents of the protruded portion, and the formation of an artificial anus. Gangrenous omentum should be removed by excision.

*Wound of the intestine* modifies the treatment, according to the circumstance of the bowel being protruded, or not. Wound of the intestine *without protrusion* is out of reach; and the discharge of fecal matter must be facilitated. Accordingly, the patient should be laid in such position that the contents of the intestine may escape through the external wound in the abdominal wall; lying on the injured side may offer the most dependent position to the opening, or the recumbent attitude with the knees drawn up may best facilitate the discharge from a wound near the umbilicus. Wound of the intestine, *with protrusion*, is a condition respecting the treatment of which surgical authorities have held a difference of opinion. Closure of the wound with sutures, and reduction of the protruded portion of intestine just into the cavity of the abdomen, constitutes the plan of treatment generally applicable. The sutures, according to Travers' observations on animals, soon become coated over with a layer of lymph, and ulceration taking place inwards, they are eventually detached and fall into the intestinal canal; while the line of incision uniting by adhesion, leaves a firm cicatrix. For this purpose, it is necessary to bring the peritoneal margins into contact, as the source of adhesion. The needle used should be a fine round needle, and the sutures, fine round sewing silk; the whole thickness of the gut should be brought together, into even apposition, and the sutures clipped off close to the knot. When returned into the abdomen, the gut is left near the external aperture, to allow of free discharge in the event of sloughing. The abdominal wound, if extensive, may be partially closed by suture; leaving a dependent opening.



Reduction of the protruded portion, just into the abdomen, without closure of the wound in the gut, and so that the two apertures, intestinal and parietal, shall correspond and lie in contact; constitutes the other plan of treatment which has been recommended by some Surgeons of experience. Adhesion taking place between the two apertures, an artificial anus is formed. The alleged advantages of this procedure are; the absence of sutures—as foreign bodies, and the prevention of feculent extravasation incident to the mechanical closure of an intestinal wound by sutures. The mechanical efficiency of sutures is, however, now no longer a question. And, the obvious disadvantages of attempting to form an artificial anus are; the liability of feculent extravasation pending adhesion of the two apertures, subject also to alteration of their relative position; and the sad inconvenience of a permanent artificial anus in some part of the abdominal parietes. But an extensive and transverse wound, or a lacerated wound of the intestine, cannot be closed effectually by suture; it will almost inevitably reopen by sloughing, and a wound of intestine already gangrenous is unfit for reduction. In these *exceptional* conditions, the formation of an artificial anus will be expedient or unavoidable.

The *after-treatment* of wounded intestine, with or without protrusion, is the same as that of rupture. The principle being to prevent any peristaltic action which might disturb the process of reparative adhesion; opium should be administered to confine the bowels for a week, when a castor-oil enema may be given. During this period the diet should be sparing and exclusively fluid; subsequently, a small quantity only of light solid food must be gradually allowed for two or three weeks.

**TRAUMATIC PERITONITIS.**—Inflammation of the peritoneum consequent on injury, whether contusion or wound of the abdomen, is denoted by certain characteristic symptoms. Pain and great tenderness on the slightest pressure, spread from the seat of injury over the abdomen, accompanied with tympanitic distension and resonance on light percussion. A dry tongue, which soon becomes brown, constant nausea or vomiting, and obstinate constipation, are the main gastro-intestinal symptoms. The patient lies recumbent with his knees drawn up to relax the abdominal muscles, as the easiest position; he breathes entirely by the thorax, the abdomen scarcely moving with each respiration; and the expression of countenance is anxious, with perhaps a nipped appearance of the nose,—owing apparently to dilatation of the nostrils and a bleating action of the alar cartilages, in connexion with the short and hurried breathing. There may be frequent hiccough. The pulse is rapid, small, and hard, often feeling like a wire drawn under the finger; increasing rapidly to 100, 120 or more beats per minute, it becomes proportionately weak and irregular as vital power declines. Effusion taking place into the cavity of the peritoneum, resonance is exchanged for dulness on percussion; commencing in the flanks, where fluid first accumulates, and extending over the abdomen, as it increases in quantity. The lymph effused, commonly of greenish-yellow colour, may be fibrinous and plastic in character, fitted for adhesive reparation; or corpuscular and curdy, with an abundance of yellow serum, or sero-purulent fluid. The peritoneal surface is more or less injected, both in its visceral and parietal aspects; the tint of redness and form of vascularity varying in different parts of the membrane. Peritonitis after abdominal injury, begins usually in about twenty-four hours or from that to three days subsequently, and may run

its course rapidly, in either of these periods or longer, and sometimes assumes a *chronic* form. Plastic or reparative peritonitis is of a *sthenic* character; corpuscular, and especially purulent peritonitis is of an *asthenic* character, and speedily fatal.

*Treatment.*—The two general characters of Peritoneal inflammation indicates the plan of treatment. In both forms of the disease, the measures to be adopted consist; in topical blood-letting by means of leeches scattered over the surface of the abdomen, and warm fomentations; coupled with the administration of calomel and opium, in pill, every four or six hours, in order to prevent effusion beyond that requisite for adhesive reparation, and to promote absorption. But in proportion as the peritonitis is or becomes, *asthenic*, depletion must be moderated. Purgatives during the inflammatory stage are useless or injurious, the constipation depending on the paralyzing influence of inflammation over the peristaltic action of the intestines. In the case of wound of the bowel, this state of quiescence is necessary for reparation, and Nature's provision for that purpose. Beef-tea and other fluid food should be the only form of nourishment given during this period. Iced soda-water or barley-water seems to allay sickness, which may also be combated by hydrocyanic acid and potash, in draught, taken occasionally. At the end of about a week any feculent accumulation may be removed as a source of irritation, by the gentle action of an oleaginous enema. In *asthenic* peritonitis, the vital power must be sustained by wine, brandy and egg-mixture, or other stimulants, and light nourishing food.

*Chronic* peritonitis will require the continued influence of mercury, with blistering of the abdomen and mercurial ointment dressing, to remove the lingering effusion.

## CHAPTER LII.

### HERNIA.

HERNIA is a generic term, signifying the protrusion of any organ from its natural cavity; such protrusion occurring through a natural or accidental aperture. Thus we recognise Hernia of the brain, through an opening in the skull; of the lung, through an opening in the thoracic parietes; of a portion of intestine, omentum, or other abdominal organ, through an opening in the abdominal wall. The protruded part is covered by the integuments overlaying the aperture and course of the protrusion; and this structural condition may be said to distinguish Hernia from Prolapsus, which is simply an uncovered and exposed protrusion of any organ, as of the uterus or rectum. Hernia and Rupture are frequently used as synonymous terms; but the latter term would imply some breaking or laceration of the textures resisting at the seat of visceral protrusion, a lesion not necessarily connected with the production of Hernia.

Abdominal Hernia may be considered, in its General Pathology and Treatment; and that of the various Special Forms of such Herniæ.

GENERAL STRUCTURE OF ABDOMINAL HERNIA.—The Hernia consists of a peritoneal sac or pouch, with a corresponding portion of the abdominal parietes, and the sac-contents.

*Sac*.—The *sac* is a prolongation of the parietal layer of peritoneum, from the aperture in the abdominal parietes; but this prolongation is of two distinct kinds in relation to a Hernial protrusion. The *sac* may be produced in two ways; either by gradual protrusion and distension of the peritoneum under pressure of the protruding organ,—forming the ordinary, *acquired* hernial sac; or it may be a pre-existing vaginal process of peritoneum from malformation, into which an organ protruding, it thus becomes a hernial sac,—the *congenital* hernial sac. Both kinds of sacs are illustrated by inguinal herniæ.

A hernial *sac* consists of two portions; the *body* or dilated portion, the lowest part of which is sometimes named the fundus; and the *neck* or constricted portion, the abdominal opening into which is named the mouth of the sac. These distinctive terms are convenient for description, and practically important. The *sac* may be *absent* in certain structural conditions of hernia,—if the protruding organ be naturally, partially uncovered by peritoneum, as the cæcum or bladder; in hernia within the abdominal cavity, by protrusion through the mesentery or the meso-colon; in internal hernia, by the formation of an adventitious band of false membrane constricting a portion of intestine; from rupture of the sac by violence; or as the result of ulceration. On the other hand, *two* sacs may have formed, both having protruded through the same aperture, constituting a double hernia. One sac may be placed behind, or within the other. The *neck* of the sac may consist of *two* constricted portions; representing the natural anatomical condition of the surrounding parts,—as the external and internal abdominal rings, in complete, oblique inguinal hernia; or, the original neck may have slipped down with a fresh protrusion. I have thus seen *three* necks produced with corresponding constrictions, in a large scrotal omental hernia.

*Structural changes in the Sac*.—The size, shape, and textural condition of the peritoneal prolongation vary according to the period of its formation, in the *acquired* hernial sac. Commencing as a small, digital depression, it assumes the shape of a funnel, and then that of a finger of a glove. These forms are, however, somewhat dependent on the region in which the hernia is developed. At this early period, the entrance to the sac is larger than the body,—there is no true neck, and strangulation of the protruded organ cannot occur. At length, the sac reaching tissues of less resistance, undergoes dilatation and acquires a spherical shape; while the entrance becoming proportionately constricted and puckered, forms a neck of variable length and calibre, so that strangulation can occur. In this state, the sac may retain the originally thin, transparent texture of peritoneal membrane. Organization ensues, in both the body and neck of the sac, more particularly in the latter portion. The sub-serous cellular tissue is the principal seat of these textural changes. They consist in the formation of new blood-vessels, increasing the vascular appearance of the peritoneal surface, and a contractile induration of the cellular texture, attended with a marked diminution or disappearance of the fat, although the person be very fat. This textural transformation of the peritoneum is evinced by thickening and opacity of the sac, especially its neck. Contraction takes place to some extent, and even obliteration, when the hernial protrusion ceases. The peritoneal transformation acquires a fibrous and less vascular character, and the consequent induration may be almost cartilaginous. This is the state of an *old* hernial sac, and the



contraction is most notable when the sac has not been subject to hernial protrusion for some time. As affecting the neck, such change is at once perilous and curative; the one, by inducing strangulation, in the event of a hernial descent of any organ; the other, by leading to obliteration of the neck of the sac.

*Abdominal Parietes—and their Structural changes.*—The layers of different textures, constituting the abdominal parietes, through which a Hernial protrusion successively passes, form what are termed the *coverings* or investments of Hernia, in addition to the peritoneal sac. The aperture or apertures in the parietes, through which the Hernial protrusion occurs, corresponds to the neck of the sac. Both the aperture and the coverings undergo remarkable changes, which may almost or altogether efface the original anatomical characters of these parts; the sac also undergoing as thorough a transformation. The changes here referred to are partly mechanical, and partly textural. The hernial aperture becomes altered in shape, assuming a circular form, and enlarged, while its relative position is gradually displaced, and usually towards the middle line; two apertures thus forming one, as that of the abdominal rings in oblique inguinal hernia. The coverings of hernia gradually become stretched and loose, so that the skin appears redundant and wrinkled; when an old hernia is reduced. Textural changes consist in thickening and induration of the parietal aperture; and in the obliteration of the individual characters of the coverings, which become more or less fused into one. All these changes result from detrusion and pressure by the hernial protrusion, operating mechanically on the parts, or inducing textural degeneration and atrophy; or textural transformation may be the result of inflammatory adhesion,—consequent on strangulation, blows, or excessive manipulation. Thus then, the whole Pathology of Hernia must be regarded as a more important aspect of study than its pure Anatomy.

*Contents of the Sac—and their Structural changes.*—All the abdominal viscera are severally subject to Hernia, though not with equal frequency; the pancreas, it is said, alone excepted. The contents of a Hernial sac, therefore, vary considerably. They are usually the intestine or omentum conjointly or singly; the small intestine, particularly the ileum, more probably than any other abdominal viscus, owing to its long mesenteric attachment and its hanging near the abdominal apertures through which herniæ commonly occur,—namely, the inguinal and femoral rings. The quantity of intestine protruded may be small,—a knuckle of intestine, or not even the whole of its circumference, or it may extend to several feet in length. Omentum, varying in quantity, is folded together, or perhaps matted into a cylindrical mass; when unfolded, it has a triangular or fan-shape, the base being below and the apex upwards at the abdominal aperture. Old herniated omentum loses its peculiar ramified adipose cellular texture, and becomes consolidated; the veins assuming a somewhat varicose condition. Sometimes apertures form in it, through which a coil of intestine passing, strangulation may ensue within the sac. Cysts, occasionally, form in the omentum, and into which the intestine may slip. When intestine and omentum co-exist in the sac; usually the omentum descends in front, and may be found to enclose and conceal the intestine, on opening the sac. Occasionally, other viscera are herniated; the stomach, liver, spleen, cæcum, sigmoid flexure, or other portion of the colon, bladder, uterus, ovaries, or even the kidney. Serous fluid, of a yellowish or brownish colour, and transparent, is always found within a

hernial sac; but in very variable quantity. Usually only sufficient to lubricate the interior and contents of the sac; this fluid may be the principal constituent, amounting to several ounces, and distending the sac. It is thus copiously secreted when the sac is inflamed or the hernia strangulated, and most abundantly in inguinal herniæ.

Adventitious or false membranes, forming *adhesions*, are met with; either as the product of inflammation in strangulated hernia, or as the result of changes in old irreducible hernia. The situation, length, thickness and density of these adhesions, present many differences of appearance. Thus, adhesions may have formed between the interior of the sac and its contents, in the shape of uniting bands, or as bridles across the sac from one side to the other, imprisoning the contained viscera; or again, adhesions may have taken place between the latter, as between two coils of intestine, or between intestine and omentum. The neck of the sac is frequently the principal seat of adhesions. Parietal and visceral adhesions not unfrequently co-exist. *Recent* adhesions are soft and pliant; *old-standing* adhesions are firm and unyielding.

Adhesion of the omentum across the sac, so as to form a distinct sac or cyst below the visceral contents, and in which fluid accumulates; constitutes the condition known as *hydrocele of the hernial sac*. A considerable quantity of fluid may thus accumulate; Erichsen drew off nearly three pints of dark-brown fluid by tapping a cyst of this kind. It is a rare structural alteration in the hernial sac; one only having been noticed by Curling, one by Boyer, one by Lawrence, two by Pott, and two by Pelletan. To these I can add one, formed in another way; by closure of the neck of the sac, after reduction of a strangulated scrotal hernia by operation. The compress applied to secure reduction, speedily induced adhesion of the neck of the sac, and fluid accumulated below in the body of the sac; soon presenting the original appearance as if the hernia had returned. I tapped this scrotal sac, and drew off several ounces of brownish fluid which was not re-secreted. The case is fully reported in *The Lancet*.

Loose foreign bodies are occasionally found within the hernial sac; they are usually round, smooth and firm, varying in size from a pea to a chestnut, and single. They consist of a laminated fibrous envelope, with a central fatty nucleus; apparently one of the glandulæ epiploicæ detached, and encapsuled.

*Strangulation*.—The structural changes coincident with *strangulation* of the hernial protrusion, demand special notice. They relate to *adhesions*, the state of the *intestine*, or *omentum*, and of the *serous fluid* in point of its colour, consistence, and odour. *Adhesions* have already been described sufficiently; their situations, and their characters as *recent* adhesions compared with the old-standing adhesions of irreducible hernia. The following changes take place concurrently in the state of the serous fluid and intestine within the sac, and are notably important; the one as being an indication of the other. With strangulation of only a *few hours'* duration; the fluid is pale yellow, clear and bright, the intestine is simply *congested*, of a deep-red colour, and its texture elastic. With strangulation of *many hours'* existence; the fluid is dark-brown, but clear, and the intestine of a purple tint, but its texture still retains its elasticity. With strangulation of *long duration*, or after violent and protracted taxis; the fluid resembles a strong infusion of coffee, it is turbid, with blood and small coagula mingled; the intestine is dark purple shading to black, it

has lost its peritoneal brilliancy and become dull-looking, its texture is leathery, not resilient; infiltrated with blood, and often having flakes of lymph adherent to its surface. With turbid serum, of a dull brownish yellow colour, and mixed with blood, coagula, pus, flakes of lymph, and even fecal matter, in which state the odour of fæces is perceptible; the intestine is approaching to a *gangrenous* condition, or has already passed into *sphacelus*. With the escape of gas through serum, of the nature last described, bubbles are produced, and the intestine is *ruptured*.

In the natural course of unrelieved sphacelated hernia, the *sac* and *integumental* coverings become inflamed, infiltrated with serum and pus; crepitation ensues either by the escape of gas from the sac or its formation in the decomposing textures externally, and gangrene of the skin supervening, the slough separates, and an artificial anus is established. Simultaneously, firm adhesion takes place between the neck of the sac and the hernial aperture; thus preventing the escape of fecal matter backwards into the abdomen. If the hernial stricture were relieved at this or even an early stage of gangrenous intestine—and short of sphacelus, the intestine might not regain its vitality; the portion of bowel remaining nipped and marked as by a band constricting it. I have thus seen strangulation of only half the circumference of a portion of intestine, prove fatal after operation.

Omentum passes through similar changes of congestion and gangrene; and if unreduced, the sac and its coverings may slough, and the portion of omentum become detached, the patient making a good recovery.

*Peritonitis* coincident with strangulation, commences about the neck of the sac, and spreads over the abdomen. The pathological appearances are not peculiar; an injected peritoneal surface, with plastic lymph of greenish-yellow colour, agglutinating the intestines or overspreading them, and puriform serum accumulated in the cavity of the peritoneum.

**SITUATIONS OF HERNIA.**—The various apertures naturally existing in the abdominal parietes offer structural facilities for the protrusion of the viscera; while apertures accidentally existing as malformations, or formed by injury or disease, also favour the occurrence of Hernia.

Taking the former as the more common and normal, or anatomical situations of Hernia, they are; above Poupart's ligament—through the inguinal canal; below the ligament—through the femoral canal; through the several apertures of the pelvis;—in front, through the obturator or thyroid foramen; through the arch of the pubes in the perinæum; below,—into the labium pudendi; by the side of the vagina; behind,—through the ischiatic notch; through the umbilical aperture; or at other parts of the abdominal wall; in ventral, epigastric, and lumbar Herniæ; and through the diaphragm.

**NAMES OF HERNIE.**—Distinctive names are given to abdominal herniæ; according to their anatomical situation; the viscus protruded; the period of life at which the hernial sac is formed; the stage of protrusion; and the pathological condition of the herniæ. Thus we recognise by their *situation*; Inguinal hernia, Femoral or Crural hernia, Obturator or Thyroid hernia, Perineal hernia, Pudendal hernia, Vaginal hernia, Ischiatic hernia, Umbilical hernia, Ventral hernia—at the linea alba, or the linea semilunaris, Epigastric hernia, Lumbar hernia, Diaphragmatic hernia. The *protruded viscus* gives names; Intestinal hernia or enterocele, Omental hernia or epiplocele, their combination being Entero-epiplocele; hernia of the stomach or gastrocele; of the bladder or cystocele. *Congenital*



hernia, and its variety, *Infantile* or *Encysted* hernia, relate to the formation of the hernial sac by the persistent patency, from birth, of the vaginal process or sheath of peritoneum in the tunica vaginalis testis; the one condition signifying complete patency of this sheath; the other, its closure at the abdominal orifice, leaving the sheath open below, and into which the hernial sac descending, the tunica vaginalis encloses the sac—forming an encysted hernia. *Complete* and *Incomplete* hernia are terms having reference to the stage of protrusion; inguinal hernia incomplete, or within the canal, is named bubonocele, and when complete, scrotal hernia in the male, labial in the female. The pathological condition of hernia gives rise to highly important practical distinctions; *reducible* hernia, *irreducible* hernia, *incarcerated* and *strangulated* herniæ.

CAUSES.—The formation of Hernia depends upon a weakness of some point of the abdominal or pelvic wall, and thus an insufficient resistance to the protruding pressure of the viscera, as subject to the compressing action of the abdominal muscles and diaphragm. The causes of hernia are, therefore, of two kinds, predisposing and exciting.

(1) *Predisposing* causes.—*Structural* predisposition consists in the natural existence of the various anatomical apertures in the abdominal and pelvic wall, corresponding to the normal situations of Hernia; and congenital malformation is predisposing, chiefly as connected with congenital and infantile inguinal hernia; or the predisposition may arise quite accidentally, from injury—by contusion, or by distension of the abdomen during pregnancy or dropsy, or as the result of disease—by abscess or other weakening disorganization of some part of the abdominal wall. *Laxity* of some of the abdominal viscera might be reckoned among structurally predisposing conditions—*e.g.*, the ileum having a long mesenteric attachment, and hanging near the inguinal and femoral rings; the omentum also loosely hanging as a sort of abdominal apron, when not tucked up to the right as in some cases.

*General* predisposition relates to sex, age, hereditary influence, and occupation.

*Males* are far more liable to hernia than females. Mr. Kingdon estimates the proportion at 2 males to 1 female, for all ages and including every form of hernia. Out of a gross total of 96,886 applicants for trusses at the City-of-London Truss Society; 78,394 were males; 18,492 females. In relation to the *population*, the frequency of hernia is uncertain; the proportion has been estimated as high as 1 in 8 of the male inhabitants of the whole kingdom, and 1 in 5 of the inhabitants of one district. In France, Malgaigne estimated the proportion as being 1 man in 13, and 1 woman in 52. In relation to the *situation* of hernia; males are more subject to inguinal, females, to femoral and umbilical hernia.

*Age*.—Differences of opinion prevail as to the liability of period of life; according to Malgaigne, hernia is less frequent before the age of 35 years than after that period; Birkett affirms, that taking all varieties of hernia in both sexes, the majority are developed before 35 years of age. Thus, by reference to statistics; out of 2343 cases recorded by Malgaigne (*L'Union Médicale*, 1854), 555, or 23·6 per cent. were under 35 years of age, and 1788, or 76·4 per cent. above that age. On the contrary, out of 9296 cases recorded by Mr. Kingdon; 5659, or 60·8 per cent., had commenced before the age of 35 years, and 3637, or 39·2 per cent., after that age. The great discrepancy between these results is easily explained; the one series records the ages of the patients at the time of observation,

the other had reference to the ages when the hernia was first noticed—the essential element in estimating the relation of period of life to hernial protrusion.

*Age in relation to Sex.*—The proportion between males and females varies considerably at different periods of life, owing to congenital predisposition. According to Mr. Kingdon's statistics for 1860–1; in the first 5 years of life, the proportion was 1409 males and only 107 females; while in the 5 years from 25 to 30 years of age, the ratio had changed to 846 males against 207 females.

*Hereditary influence.*—The children of ruptured parents are frequently affected in like manner. Both sexes evince an equal tendency to be thus influenced; the proportion being about 34 per cent. This influence, paternal, maternal, or from both parents, is manifested mostly in infants under 1 year; the proportion being about 12 per cent. of the whole number under that age. This fact is referable, apparently, to an arrested closure of the ventral orifice of the vaginal process of peritoneum, and the obliteration of that sheath; and also to an abnormal elongation of the mesentery; both of which, as congenital structural conditions, are very probably much influenced by hereditary conformation.

*Occupation.*—All persons are liable to hernia; but the labouring class is most subject, seemingly, however, irrespective of any particular trade or occupation. Comparing the twenty-five largest classes of occupation, arranged in the order of their magnitude from the census of 1851, with the numbers of each class who applied to the Truss Society during three successive years; Mr. Kingdon finds that the number of such patients bears a direct proportion to the numerical magnitude of the classes to which they respectively belong, and not to the severity of the toil.

(2) *Exciting Causes.*—Any sudden and forcible diminution in the capacity of the abdominal cavity, resulting from the compressing contraction of the abdominal muscles, may be productive of hernia. Hence, it often happens in strained attitudes and postures of the body during the effort of any violent muscular exertion; and in particular, hard riding on horseback, violent running or jumping, acrobat performances and ballet dancing, high pitch singing, violent coughing, straining defecation or micturition in connexion with constipation or stricture, and in difficult parturition. The production of hernia may be sudden, but perhaps more commonly it is of gradual formation.

*REDUCIBLE HERNIA.*—*Symptoms.*—A soft compressible swelling or lump appears at some part of the abdominal parietes; commonly, in the groin just above the middle of Poupart's ligament—at the internal abdominal ring; or below the ligament internally, and corresponding to the saphenous opening. This tumour increases in size when the patient stands, and still more so when he coughs, and the latter act communicates an impulse more or less perceptible to the hand when placed upon the tumour; on the contrary, it diminishes in the recumbent posture, and can be made to disappear by gentle compressive manipulation in the direction of protrusion,—the contents of the hernial sac, with sometimes the sac itself, being returned into the abdomen, whence this procedure is denominated the *reduction* of Hernia. The tumour will probably reappear, when the patient stands upright, and the pressure is removed from the hernial aperture. There is no pain or other sign of inflammation in connexion with a reducible hernial tumour.

*Intestinal hernia, —enterocele, and omental hernia. —epiplocele, present*

tumours having distinctive characters and which are tolerably perceptible. Enterocele is soft, compressible and elastic, uniform and globular; it yields a distinct and distending impulse on coughing, and a gurgling noise as it returns, suddenly, into the abdomen. Epiplocele is harder, inelastic, and lobulated; yields a less distinct and a solid impulse on coughing, and returns, slowly, as a lump into the abdomen. *Entero-epiplocele* presents a tumour of mixed characters, and this is the more frequent condition of hernia; or examination fails to detect the visceral nature of the protrusion,—whether it be intestine, omentum, or both. An accumulation of fluid in the hernial sac, will disguise the visceral nature of its contents, and simulate intestine. Thus, in one case of apparently scrotal enterocele; I found, by operation, only half the diameter of a knuckle of small intestine protruded at the external abdominal ring, and the sac distended with serous fluid.

Various kinds of swelling in the regions of Hernia simulate that disease; but their *diagnosis* will be more usefully noticed in describing Special Herniæ.

*Treatment*.—This may be mechanical and palliative, or operative and curative.

(1) *Mechanical* treatment consists, in the reduction or return of hernia—by the manipulative procedure technically named the *Taxis*; and the prevention of its return,—by means of a suitably fitting support or Truss. The constant wearing of such an appliance may, perhaps, lead to obliteration of the neck of the sac, and a radical cure.

*Taxis*.—Reduction is effected by placing the patient in the recumbent position, relaxing the abdominal muscles by bending the thigh upon the abdomen; and then gently compressing the tumour with the fingers, back in the direction of protrusion.

*Truss*.—The characteristic qualities of a Truss are; its lightness, firmness, elasticity, suitable adaptation to the configuration of the wearer, and sufficient strength of spring to prevent the escape of the rupture from the abdomen. The instrument consists of a pad or cushion attached to a metallic spring, with straps, so arranged that its movement during the varied postures of the body may be restrained. Bearing in mind these essential elements of truss construction, a detailed description of the various forms of Trusses employed for the different situations of hernial protrusion, will be far better understood in connexion with Special Herniæ. The circular spring truss is, generally, the most suitable form. The names of trusses, more or less in common use, are; Salmon and Ody's self-adjusting truss, which has a pad revolving on a ball and socket; the Maidstone truss, with a sliding pad; Edwards' truss, with a revolving and sliding pad; Adams' graduated pressure truss; Arnott's graduated pressure truss; Coles' truss, with a spiral spring acting on the pad; Tod's truss, affording more effectual compression at the internal abdominal ring; Newson's wire truss, affording more effectual security against displacement; Egg's truss, which requires no fastening; the Moc-Main lever truss; the Tail-padded truss; and Bourjeaud's elastic india-rubber belt and pad, which may be more conveniently used for children.

A truss having been applied, it should be tested, by desiring the patient to sit on the edge of a chair, open his legs widely, bending the body forwards, and cough several times. If, in that posture, and with such effort, the hernia still remains up, without any tendency to slip down behind the pad; the truss assuredly fits well, and will prove effectual



under all ordinary circumstances. The Truss should be worn daily, and taken off only at night. Irritation consequent on continued pressure of the pad, may be relieved by washing the skin with spirit lotion, and substituting an elastic air-cushion for a while.

(2) *Operations for Radical Cure.*—The principle implied by the cure of Hernia, is the obliteration of the sac or its neck.

*Compression* of the whole neck of the sac by means of a well-fitting truss, has led to its adhesive obliteration, in hernia at an early period of life; the cure also being safe and remaining permanent. But this procedure must be continued for a considerable time, at least two years; and then, as a precautionary measure, prolonged for two years more.

Various *operative* procedures have been devised for the radical cure of hernia, most of which having justly become obsolete may be here omitted. The object being to obliterate the sac or its neck; this may be accomplished, either by simple invagination of the sac and integument into the neck, the invaginated portion acting as a plug and closing the neck by adhesion between it and the hernial aperture; or, in addition to invagination, by the approximation and adhesion of the surrounding textures, thus producing further consolidation. Three operations are practised, in accordance with these two methods; Gerdy's and Wurtzer's operations are simply *invaginations*; Mr. John Wood's operation is, in addition, a *compression of the boundaries* of the hernial canal in its entire length.

The performance of these operations will be described in connexion with the treatment of *inguinal* and *femoral* herniæ.

The results of any such occluding operation are uncertain; there is some risk to life, unwarrantable perhaps in order to remedy the purely mechanical inconvenience of a reducible hernia; and greater uncertainty as to a permanently successful result, without the inconvenience of continuing to wear a truss for protection against a relapse.

**IRREDUCIBLE HERNIA.**—This condition signifies simply that the contents of a hernial sac cannot be reduced or returned, entirely at least, into the abdomen; but there is no obstruction to the passage of feces through the intestinal portion, nor to the circulation,—the hernia is not incarcerated nor strangulated. The contents are, generally, for the most part omental, with intestine and mesentery, and the hernia is usually long-standing and of large size; the gut perhaps slipping up occasionally, leaving the omentum unreduced. The largest irreducible hernia I have ever seen was in the scrotum of a man in the Millbank Penitentiary—the scrotum, on the right side, hung down nearly to the knee; and Mr. Birkett met with a double scrotal hernia in a bricklayer, aged fifty-five years, where the tumour reached down very nearly to a level with the patellæ, and its circumference measured thirty inches. The left hernial tumour was the larger, although it had existed only about three years, whilst the right had been there twelve.

*Causes.*—Enlargement of the omentum or mesentery, as by an accumulation of fat, may lead to an irreducible condition of hernia; although the portion protruding through the mouth of the sac may be small. Adhesions between the sac and its contents, or adhesion of the neck of the sac; may severally produce the same result. Contraction of the neck is sometimes thus occasioned, or an hour-glass contraction of the sac; either of which alterations of shape will further prevent reduction. Hernia of the cæcum or of the bladder are irreducible, owing to their peculiar anatomical conditions.

*Consequences.*—The increasing size and weight of an irreducible hernia entails proportionate mechanical inconvenience, coupled with occasional dragging pains, nausea, or vomiting, and colicky, disordered action of the bowels. Besides all this inherent discomfort, the hernial contents are liable to the accidental peril of inflammation, from injury by blows or other external violence, or from strangulation, on any occasion of unusual exertion. Omental hernia is less dangerous than intestinal protrusion, but there is always the risk of a piece of bowel slipping down and inducing strangulation.

*Treatment.*—The indications are twofold; to prevent any increase of size, by additional protrusion; and the peril of inflammation thence arising, or from external violence. The support of a truss, with a large hollow pad for the protection of the hernia, will best fulfil these indications; but a very large hernia must be supported by means of a suspensory bag. Any violent exertion, or constipation, should be avoided as much as possible.

Reduction can sometimes be accomplished by diminishing the contents of the hernial sac. Mr. Bransby Cooper recommended a gradual course of treatment—confinement of the patient to bed for several weeks on low diet, with the continued application of ice to the tumour; and if it contain much omentum, the administration of small doses of blue pill and tartar emetic, in order to promote absorption of the fat. This plan has proved successful in some cases. Suspending the patient with his head downwards may induce the hernial contents to return into the abdomen. But the contents of an old hernia, when returned into the abdomen, may be a source of so much irritation, that any attempt at reduction, and especially by a mechanical and suddenly effective proceeding, should always be well considered.

*Inflamed Irreducible Hernia*—closely resembles strangulation, in its symptoms and treatment. If arising from any injury to the tumour, from a blow or other external violence; the peritonitis commencing in and spreading from the sac, may be subdued by rest and leeches, enemata and abstinence from food, with perhaps the administration of calomel and opium.

*Incarcerated Hernia.*—This term is intended to signify such imprisonment of the contents of a Hernia,—itself irreducible, as shall obstruct the passage of fæces through the intestinal portion; but there is no impediment to the circulation—no strangulation.

The *Symptoms* are, some increase of size and painful sense of weight, in the tumour, without any tenderness or pain about the neck of the hernial sac; and this local condition is accompanied with constipation, and nausea or even vomiting. These symptoms have a chronic character, unlike those of strangulation.

*Causes.*—An accumulation of feculent matter or flatus in the fold of protruding intestine; and often preceded by constipation and the swallowing of hard, indigestible food. It occurs commonly in elderly persons, with large abdominal capacity.

*Treatment.*—Excitation of the peristaltic action of the intestine is the natural indication, as to the kind of remedial measures for removal of the obstruction; the patient remaining, of course, in the recumbent position. Aperient enemata answer best, and in particular a colocynth injection; purgatives administered by the mouth may operate beneficially, in the absence of vomiting. When some relief has been thus obtained, reduc-

tion of the intestinal contents may be advantageously attempted; any previous manipulation of the accumulation might tend to increase it.

**STRANGULATED HERNIA.**—Strangulation of a Hernia is said to have occurred when the protruded viscera—intestine, omentum, or both, are so constricted; that, in addition to functional obstruction, as of the passage of feculent matter through the intestine, the vascular communication is also intercepted and the circulation of blood arrested,—a condition which soon leads to gangrene.

The state of the hernial contents of the sac, in the early and advanced stages of strangulation; have been already sufficiently described, in speaking of the general structural changes of Hernia.

**Seat of Stricture.**—Generally, the stricture is situated at the *neck* of the sac; but it may be either in the neck, by thickening of this portion of peritoneum; or external to and around the neck, by constriction of the surrounding tendinous or ligamentous structures forming the hernial aperture. These structures do not exert any active pressure upon the neck; the protruded viscus passes through an aperture too narrow for its reception, and, pressing outwardly, is resisted by the unyielding boundaries of that aperture. Hence, the precise seat of stricture may be in any portion of its circumference,—at whatever part resistance is greatest. This structural condition will be noticed more particularly in connexion with special Herniæ. Occasionally, the stricture is situated in the *body* of the sac, which may have assumed an hourglass-shaped contraction. Lastly, sometimes it forms *within* the sac; as a band of adhesion, or there may be an aperture in the omentum constricting a portion of intestine.

**Symptoms.**—(1) *Local.*—The tumour is irreducible, and the impulse on coughing is diminished or altogether absent, owing to the stricture preventing a transmission of the shock to the contents of the sac. The situation of stricture may sometimes be thus determined, as Luke pointed out, by observing the line where the impulse ceases to be felt. There is some enlargement of the hernial tumour, if a pre-existing one; or it may have recently made its appearance. It is tense and elastic, the more so if intestinal, and in proportion to the accumulation of serous fluid in the sac; but if omental, the tumour may still retain its characteristic doughy consistence. Tenderness soon supervenes about the neck of the tumour, and is thence diffused over the abdomen, which becomes painful and tympanitic as peritonitis is established. The pain varies in kind and degree. Usually, referred more particularly to the umbilicus, there is a peculiar sensation of constriction across the belly, and perhaps a dragging-down sensation; or pain may be slight, or absent throughout. A constricted portion of *intestine* is functionally paralysed, so that its peristaltic action is arrested. The fæces and flatus accumulate in the intestinal canal above the seat of stricture, and complete constipation ensues; although the bowel below may perhaps act once, and thus somewhat relieve the sense of colicky distension. Vomiting soon sets in; first, emptying the contents of the stomach, then throwing up bile and mucus, and lastly, the contents of the intestine,—the vomited matters acquiring a more or less decidedly feculent character. *Omental* hernia is attended with similar symptoms, excepting that they are less severe, and the constipation is necessarily far less marked. The symptoms of strangulation are more acute if the hernia be recent and small, than if it be old-standing and large. Lastly, the position and respiration of the patient, as influenced by *peritonitis*, are peculiar. He



lies upon his back with the knees drawn up to relax the abdominal muscles, and the breathing is chiefly thoracic, in short hurried, catches, interrupted perhaps by hiccup,—always an unfavourable omen. (2) *Constitutional Symptoms*.—Inflammatory fever accompanies the development of peritonitis, and is denoted by the usual symptoms,—of a *sthenic* type in the young and vigorous, *asthenic* in the old and enfeebled. But the phenomena of the vascular and nervous systems are characteristic. The pulse is quick, small, and hard or wiry, and prostration speedily supervenes; the pulse increasing rapidly in frequency to 100, 120 or more beats per minute, and becoming proportionately weak and irregular, as collapse ensues. A cold, clammy sweat bathes the skin, and the expression of countenance is nipped and anxious; but there is often a notable relief of all the abdominal symptoms; the pain ceasing, the vomiting subsiding, perhaps even the bowels being relieved by an evacuation. Yet, in this deceitful state of tranquillity, the patient lies on the verge of death. Sometimes with *rupture* of a sphacelated portion of intestine, fæcal extravasation takes place, when an accession of sudden and most intense pain betokens that event; otherwise the *relaxation* coincident with sphacelus is a fatal omen, and in a state of overwhelming collapse, death occurs almost imperceptibly.

**DIAGNOSIS.**—To determine the diagnosis of strangulated Hernia, a *tumour* of hernial character, must always be sought for and discovered. But the size of such tumour is unimportant—a small hernial protrusion embracing only a portion of the circumference of the intestine, will be quite sufficient to produce the most severe constitutional symptoms of Hernia. A patient may have suffered for some days from nausea and vomiting, with frequent desire to relieve the bowels, and inability to evacuate, passing only perhaps a little wind. The co-existence of a hernial tumour with these symptoms will complete the diagnosis. Without such tumour, similar symptoms may depend on mechanical obstruction of the intestine within the abdomen, and as arising from various causes;—the pressure of a tumour, the ligature of a fibrous band, ileus, enteritis, or simply constipation. There are also the rare forms of internal abdominal hernia to be considered, in the absence of a tumour. A strangulated hernia being present, there may be a notable *absence* of the symptoms of strangulation,—local and constitutional. Thus, the usual tension of the tumour and tenderness about its neck, may be wanting, and there may be no abdominal pain or tenderness on pressure,—even with pus-forming peritonitis; vomiting also may be absent throughout the whole course of strangulation; while the circulation and nervous system are, perhaps, singularly irresponsive to the local condition. Some sharpness of pulse and anxiety of countenance, are, however, generally indicative of strangulation; and at length the patient succumbs to prostration.

The diagnosis of strangulated hernia from incarcerated, and from simply irreducible hernia, has been noticed in the definition of these several conditions of Hernia. *Inflamed* irreducible hernia, most nearly resembles strangulation. Hernia in this state exhibits all the local signs, and excites the constitutional symptoms of inflammation. The combination of those indications which characterize the condition of strangulation, does not, however, exist.

*Peritonitis conjoined* with irreducible hernia renders the diagnosis equivocal. But, the peritoneal inflammation cannot be traced to the neck of the tumour as its origin and source, and it may be most intense at

some distance from the sac ; while the constipation and vomiting are not conspicuous symptoms.

In *double hernia*, both of which are irreducible, one may be strangulated, and the other not. Here the diagnosis must be determined by careful comparative observation ; as to the local conditions of the two tumours,—in point of elasticity and tenderness of the neck, and to connect the abdominal and constitutional symptoms with one rather than the other, as their source.

Other tumours, compared with strangulated hernia, must be distinguished by their respective characters.

*Causes.*—Sudden protrusion of a viscus, as of intestine or omentum, by some violent exertion, is the common cause of strangulation. But it occurs in two distinct conditions of hernia. In an *old standing* and perhaps irreducible hernia ; a larger descent than usual may take place, through an aperture too small, although previously large, and the hernial contents gradually undergo strangulation. In a *newly-formed* hernia ; the protrusion takes place through a tight and previously undilated aperture, and the hernial contents rapidly become strangulated. *Distension* of a pre-existing visceral protrusion, as of the intestine by fæces or flatus, and of the omentum by venous congestion ; may occasionally induce strangulation. Spasm, formerly regarded as a cause, can scarcely have any effect ; the hernial aperture being tendinous or ligamentous, or certainly not muscular, although indirectly subject to the action of the abdominal muscles. No *period of life* is exempt from the liability to strangulated hernia ; it occurs in the newly-born infant and in centenarians.

*Treatment.*—The indication is the removal of the constriction from the strangulated hernial tumour. This may be accomplished by gentle reduction of the hernial contents through the stricture ; or, failing thus to fulfil the indication, then an operative proceeding for the division of the stricture, must be had recourse to, without a moment's delay.

(1) *The Taxis.*—This term signifies the manipulative procedure of reducing a hernia ; it must be conducted on certain principles, and should be continued only for a certain time.

The principles are, to dilate the neck of the sac, and to diminish the bulk of the protrusion. In accordance with the former principle, the patient should be placed in the position requisite to relax any unfavourable muscular action on the neck of the tumour. The recumbent posture with the knees drawn up and the body inclining forwards, will relax the abdominal muscles. With this view also, the patient's attention may be diverted by asking him questions occasionally during the attempt at reduction. Steadying the neck of the tumour, as far as practicable, with one hand, the other should grasp the body of the tumour ; when by a gentle, uniform, compressive manipulation, the hernial contents may be returned. The direction of the pressure is specially important ; it should always be made in the course of the hernial descent. Slight traction downwards before using compression will sometimes facilitate reduction ; apparently by freeing the contents from the neck of the sac. The taxis having been thus employed for a few minutes, any fluid in the sac may partially pass into the abdomen, accompanied with some diminution in the size and tension of the tumour ; the flatus of the intestine may also escape into the intestinal canal above the stricture, accompanied with a gurgling sensation and sound, and then the intestine goes up with a sudden jerk. Omentum may then have to be reduced.

Dilatation of the hernial aperture, by insinuating the tip of the *finger* into it, is a manœuvre which has been successfully resorted to by Baron Sentin; and this procedure seems to have been employed effectually, in some cases, by Mr. Erichsen. It is most practicable in femoral hernia,—where the upper edge of the saphenous opening is sharply defined, and especially as felt in a thin person; and when the stricture is seated at the external abdominal ring.

The *amount* of compression justifiable, varies with the state of the strangulated intestine, as denoted by the one symptom—vomiting. Before this has occurred, the pressure should be gentle; after vomiting, any manipulation must be particularly delicate and cautious, lest the gangrenous bowel be irreparably damaged or burst. The *duration* of the taxis is equally important; for moderate but continued manipulation may be as damaging as a violent effort at reduction, and any such handling is more likely to induce inflammation. Half an hour may be roundly stated as the period beyond which the taxis should not be prolonged.

*Further Measures for Relaxation.*—If the taxis do not soon succeed, certain auxiliary measures may be resorted to with advantage; and, under such influences, reduction should be re-attempted. The patient may be placed in a hot bath (96°—100° F.), and allowed to remain until some faintness supervenes, during which period, the taxis is reapplied in the bath. This failing, he should be removed, and wrapped in blankets. Then chloroform may be administered cautiously, and under its influence another attempt at reduction be made, yet once more only.

It would be idle to even enumerate all the other measures which have been resorted to; some are pernicious, all are useless, with perhaps two exceptions. *Opium* may be administered with advantage in one period of strangulated hernia. When vomiting has commenced, and the stomach has been emptied by two or three vomits, there is—according to Mr. Birkett's careful observation—a short interval of repose which continues until regurgitation takes place from the small intestines. If this moment be seized, and a full dose of opium in solution, with a little stimulus, be given, the hernia can sometimes be reduced. But when once the vomiting of regurgitated fluids has supervened, the inward administration of medicine is pernicious. Purgatives are positively killing, and enemata at least useless. Yet how often do we hear of or meet with patients who have been positively drenched with such medicines for days or even a whole week, under the care of a chemist or possibly under medical supervision, before an operation for the relief of strangulation. This sad mistake occurs commonly by overlooking the nature of the symptoms; the constipation and vomiting being regarded simply as a disorder of the stomach and bowels, without making any examination to discover a hernial tumour. Sometimes the essential pathology of strangulated hernia seems to have been misunderstood, as in a case alluded to by Mr. Birkett; an operation having been urged for the relief of a strangulated hernia, the gentleman in attendance immediately replied:—"But will it not be desirable to wait until the vomiting has ceased before the performance of the operation?" *Cold applications* to the tumour, by means of the ice-bag or freezing mixture, seem to have some advantage in facilitating reduction by the taxis. The blood-vessels being thus partially emptied, the bulk of the protrusion is somewhat diminished. But the tendency to gangrene will be increased by prolonged cold. Such applica-



tions are more useful as preventive of strangulation; and after strangulation has existed twenty-four hours, cold is inadmissible.

*Injuries inflicted in the employment of the Taxis.*—They affect separately, or in combination,—the hernial contents, the sac, the integumental coverings. The nature of the injury is always the same—contusion or bruising, and the bowel may be lacerated or burst.

Thus, with regard to the *hernial contents*; intestine being most delicate, is more commonly injured than omentum. Indeed, the latter may sometimes protect the former. The injury liable to be done to the bowel should be estimated less by the symptoms of strangulation than by the violence and prolongation of the attempts employed in the taxis. After the first act of vomiting, and during the succeeding twenty-four hours, the bowel may be killed by manual pressure, or cut by pressure against the hernial aperture. In either case, the entire calibre of the bowel becomes divided; forming an artificial anus, or death takes place in consequence of feculent extravasation backwards into the abdomen. After the expiration of twenty-four hours, the softened state of the bowel will probably cause it to yield under any violent or prolonged use of the taxis. Rupture usually occurs at the convex border of the gut, at the furthest point from the mesentery, and the rent is in the direction of the circular muscular fibres.

The *signs* of burst bowel are very characteristic. If an enterocele, the bowel glides away from the pressure of the finger and the tumour disappears. But this apparent reduction is not accompanied with that sudden and peculiar gurgling subsidence which the return of an unburst bowel into the abdomen produces. The patient immediately complains of intense pain in the abdomen, vomiting ceases, succeeded however by retching and hiccup with utter collapse and death. Sometimes, inflammation and suppuration take place in the sac, and extending through its coverings, the abscess bursts, leaving a fistulous communication with the interior of the intestine. Violent compression also produces hæmorrhage into the sac, forming a mixture of blood and coagula with the serum; or by aggravating the inflammation, flakes of lymph or puriform effusion result.

The hernial *sac* is liable to two forms of injury; displacement, and laceration or rupture. Both may happen together, and almost necessarily in connexion with considerable force.

By *displacement*, the sac is detached, to a greater or less extent, from the surrounding textures. This injury occurs usually in inguinal hernia. The neck of the sac is more frequently affected than any other portion. It becomes detached from the inner surface of the internal abdominal fasciæ, and carrying with it the surrounding portion of parietal peritoneum, a pouch is thus formed within the fascial membrane of the abdomen; into which the hernia may be forced, and being retained therein, is lost to touch and sight. Sir Charles Bell recorded a case of this injury, in the London Medical Gazette, 1828. The entire hernial tumour may be pushed into the abdomen, in a mass; the tumour disappearing, whilst the contents are still strangulated by the mouth of the sac. This injury—first described by French writers, as “*réduction en bloc*,” is of rare occurrence. Mr. Luke’s paper in the Med. Chir. Trans., 1843, will give further information.

By *laceration* of the sac, commonly its neck along the posterior aspect, the hernial contents escape through the rent into the sub-peritoneal con-

nective tissue. Extending backwards under continued pressure, and detaching the neighbouring peritoneum, the hernia is lodged between that membrane and the internal abdominal fascia. This injury is more frequently produced in that variety of inguinal hernia, known as congenital, or its sub-form, infantile hernia. It is inflicted very easily under the influence of chloroform, and especially in a youthful patient.

The *signs* are these:—the tumour becomes smaller and flaccid, slowly diminishing as the pressure is continued until it almost disappears; but as the hernial contents escape, the Surgeon fails to feel the well-known sensation of a gurgling jerk produced by the return of bowel into the abdomen, and the direction of this apparent reduction seems wrong. Symptoms of strangulation recur and perhaps with aggravated severity, the tumour also may reappear and recede again under the application of slight pressure.

The *coverings* of the hernial sac are liable to injury from rough handling; contusion producing ecchymosis of the integument, subcutaneous extravasation of blood and œdematous infiltration, and inflammation, leading to suppuration and sloughing.

*Symptoms after Reduction.*—Vomiting ceases usually, or it may continue for a while as the effect of chloroform. The pain in the abdomen and sense of constriction, are immediately relieved, and soon cease.

*Persistence of the symptoms of Strangulation*, after *apparent* reduction, may arise from three conditions of injury; rupture of the intestine with feculent extravasation into the abdomen; displacement of the sac into the abdomen, or apparent reduction en bloc; rupture of the sac, and apparent return of its contents. These conditions—thus agreeing in the disappearance of the tumour—may perhaps be diagnosed by their structural modes of production, already noticed. Certain conditions of the hernia itself, after *real* reduction, may also perpetuate the symptoms; such as internal stricture—within the sac, reduction having overcome only the external stricture of the hernial aperture; or persistent constriction of the viscus which had been protruded, as the result of plastic effusion forming a peritoneal band. The still strangulated viscus remains functionally paralysed,—the bowel not regaining its peristaltic action, and the constricted portion becomes gangrenous; with unabated continuance of peritonitis, constipation and vomiting as the symptoms of strangulation.

The *treatment* of these various misadventures of the taxis may be conducted on one and the same general principle. With *persistent* symptoms of *strangulation*, after apparent or after real reduction; an operation must be resorted to, with the view of reaching the still existing seat of stricture and dividing it. Care must be observed to modify the operative procedure according to the structural conditions of the hernia, as already described; especially in regard to the apparent reduction arising, either from displacement of the sac into the abdomen, or from rupture of the sac externally. With a constricted portion of bowel after its reduction, of course no stricture would be discovered by operation.

Any temporary continuance of the symptoms of strangulation, due to previous constriction, must not be mistaken for persistence, due only to a persistent cause. Their gradual subsidence or continuance, the case being watched from hour to hour, will probably enable the Surgeon to determine as to the necessity for operative interference.

(2) *Operation for Strangulated Hernia.*—Herniotomy.—The Taxis

having failed to effect reduction; an operation for the removal of the impediment to reduction,—by division of the stricture and liberation of the protruded viscus, should be resorted to without a moment's delay. The general indication as to the *absolute necessity* and *extreme urgency* of this operation may be thus stated:—persistent vomiting, and especially of a feculent character, showing the regurgitation of the contents of the small intestine.

The taxis must be forthwith abandoned; or, if not previously tried, it should be gently tried only once under the immediate administration of chloroform; and that attempt failing, any further delay of operation would be attended with hourly increasing peril. According to the results of Mr. Luke's experience, of 69 cases of strangulated hernia operated on within the first forty-eight hours of strangulation, 12 died, or 1 in 5·7; whereas of only 38 cases operated on after more than that period had elapsed, 15 died, or 1 in 2·5,—showing a fast increasing proportion. This large mortality is due, not to the operation, in itself, but to the state of the hernial contents when operated on. Gangrene will have almost inevitably supervened, and aggravated probably by repeated attempts at manipulative reduction. Two maxims, by Surgeons of large experience, may serve to impress on the mind the danger of prolonged taxis, and of the delay of operation. Desault observed,—“Always think favourably of a case of strangulated hernia when the taxis has not been used;” and Mr. Hey observed, that—“I have often regretted performing the operation too late, but never having done it too early.” Whenever, therefore, the taxis has failed, and perhaps vomiting is persistent, the operation must be resorted to at once, under the influence of chloroform,—which will have been already administered in the case of a first and only attempt to accomplish reduction by taxis at the extreme period of urgency.

*Modes of operation.*—Two modes of performing the operation are generally applicable; either by opening the hernial sac, exposing its contents, and dividing the stricture wherever situated, *within* the sac; or by dividing the stricture *outside*, leaving the sac unopened,—as was originally performed by Petit in 1718, and revived by Aston Key and Luke. Of the two latter authorities; the one wrote an admirable memoir On the Advantages and Practicability of Dividing the Stricture in Strangulated Hernia on the Outside of the Sac; the valuable paper of the other appeared in the Med.-Chir. Trans., vol. xxxi. M. Guérin has divided the stricture subcutaneously, as described in the Gaz. Méd. de Paris, Aug. 1841.

*Conditions for choice of either Operation.*—That of not opening the sac, is always preferable from its comparative safety and simplicity; whenever it may be effectual for the relief of strangulation and reduction of the hernia. The guiding principle of choice may perhaps be thus enunciated:—whenever the symptoms are of such moderate severity that the hernial contents might be safely returned by taxis,—were it practicable—any existing stricture outside the sac may be divided and the hernia reduced; on the contrary, whenever the symptoms are of such severity as would indicate a state of the bowel, especially, which would be hazardous to attempt to reduce by taxis, the sac must then be opened. Hence, Mr. Birkett would define the following to be the principal conditions that should determine this election;—for not opening the sac,—that the symptoms of strangulation have existed only a few hours and have not been very severe, the vomiting not stercoraceous nor prostration extreme,



the hernia a simple enterocele, and which has not been subjected to forcible attempts at reduction; for opening the sac,—prolonged strangulation, stercoraceous vomiting and marked prostration, the hernia compound,—an entero-epiplocele, and which has been subjected to repeated, protracted, or forcible taxis. Duly comparing these opposite conditions of operation; it will appear that the number of cases of strangulated hernia eligible for operation, without opening the sac, is unfortunately very limited.

The *relative results* of both modes of operation may be gathered sufficiently from the following statistics. Out of 84 cases of hernia operated on by Mr. Luke; in 25 the sac was opened and 8 died, whereas in 59 the sac was not opened and only 7 died. The additional cases reported by Mr. N. Ward, give a total of 36 deaths in 153 cases of Petit's operation. On the other hand, of 77 cases reported by Sir A. Cooper, in which the sac was opened, 36 proved fatal; and of 545 cases collected by Dr. Turner, 260 died. Regarding *femoral* hernia in particular, where the stricture is commonly outside the sac; of 31 cases operated on by Luke, in 7 only was it necessary to open the sac. Inguinal hernia cannot generally be relieved externally; of 20 cases operated on by the same Surgeon, in 13 it was necessary to open the sac.

(a) *Operation in which the sac is opened.*—The *instruments* required are few and simple—a scalpel with a single-cutting edge, dissecting forceps, directors, straight and curved; Key's broad hernia-director, bistouries blunt-pointed, straight and curved for dividing the stricture, or Sir A. Cooper's hernia-knife; retractors. It will thus be seen that the only peculiar instruments, are the hernia-director and the hernia-knife.

The *operation* consists, in exposing and opening the sac, finding and dividing the stricture, the management of adhesions and the visceral protrusion. The patient lying down on the edge of the bed or table, with the part well exposed; the bladder is emptied and the hair shaved from the seat of operation, in the ordinary inguinal and femoral herniæ. An incision is then made of sufficient length over the neck of the tumour, by pinching up a fold of integument, and transfixing with a scalpel through its base; the back of the knife being turned towards the hernia, the edge is made to cut outwards through the fold of skin. On letting go the fold a linear incision is presented in the direction of the neck of the tumour, which may be extended at either end as occasion requires. The cellular texture and fat are then carefully divided, on a director or by a scratching dissection, with the scalpel and forceps; this precaution will be necessary, as the integumental incision may have almost exposed the sac, so little is there seen of the separate layers or coverings of hernia as distinguished in the diagrammatic descriptions given in anatomical works. An anatomical or an inexperienced operator may make as many layers of covering as he pleases; and with no harm to the operation, but perhaps with safety to the patient. Any small bleeding artery had better be secured by a twist with the forceps, lest it should obscure a clear view of the sac. This may be recognised by its tension and whitish appearance; thin and translucent, and often coloured from the hernial contents, in recent hernia; thick and opaque-white, and not transmitting any colour, in old hernia. *To open the sac*; a little bit should be pinched up with the forceps, and by a slight rotation having ascertained that no portion of intestine is included, the knife is laid flat and a small button-hole aperture made under the point of the forceps; a little serous fluid will escape, having a yellowish

or brownish colour according to the state of the hernia, and a small bleb of glistening intestine or a bit of granular fatty omentum, more or less darkened in colour, may rise up through the aperture in the sac. A director is introduced and care taken that it lies entirely between the gut and the sac, no portion of bowel overlapping. This can perhaps be plainly seen through the more translucent peritoneal sac of a recent hernia; but with an opaque sac, it will be advisable to use the broad director as a safeguard. Then, introducing a probe-pointed bistoury, along the groove of the director, the sac is slit up towards its neck—the usual seat of stricture; and turning round the instrument, a slit is made towards the fundus, so as to thoroughly expose the hernial contents. A practised operator will perhaps prefer the finger to a broad director, and I almost habitually use it as such instead.

The *seat of stricture* is sought for by gently examining the visceral contents of the sac. Situated commonly at the neck of the sac, the protrusion is there constricted and pedunculated. The stricture will, therefore, not generally be visible, but it can be easily felt. Before passing the finger up to the neck of the sack; the body of the hernia, including both the sac and its visceral contents, should be gently steadied with the other hand, in order not to drive the neck before the finger. At the same time, the finger is passed up and its point slightly insinuated, as a protector, between the protrusion and the stricture. Then, using the finger as a director, the blunt-pointed hernia-knife is slipped up along the curve of its palmar surface, and just sufficiently far to bring the cutting-edge of the knife under the stricture. On gently elevating the handle, the stricture yields with a creaking sound; but it should be divided to a very limited extent, from one-eighth to a quarter of an inch, or just sufficient to admit the point of the finger to pass on into the abdomen when the knife is withdrawn. The *direction* in which the stricture should be divided varies with the hernia, and will be particularly noticed in describing the operation as performed for inguinal and femoral herniæ.

*Reduction* of the visceral protrusion is determined by the state of the parts. They should be carefully examined to discover; whether there are any adhesions either between the parts, or between them and the sac; and to ascertain also whether the protruded parts are in a sufficiently healthy state for reduction.

If the hernia be, as usual, an entero-epiplocele; the intestine will probably be seen, or more entirely, on drawing aside the omentum. Then—if both be healthy and without adhesions—the intestine should be returned first, by a gentle kneading action with the fingers to empty the gut and replace it, followed by a similar manipulation to replace the omentum. In concluding the operation, the point of the finger should be gently introduced into the abdomen to feel that the mouth of the sac is free; excepting in those unusual cases, where the bowel or omentum is allowed to remain unreduced. The *bulk* of intestine, owing to its quantity and distension with flatus, will sometimes render the reduction of the whole mass impracticable. In one such case, Mr. Tatum punctured the bowel with a grooved needle, and allowed the flatus to escape. The result was completely successful, but the justifiability of this instance as a precedent may well be questioned.

*Adhesions* must be dealt with according to their nature and connexion with the bowel or omentum. As to the *bowel*; recent adhesions may be gently separated, between a coil of bowel, or between it and the sac; *old*

adhesions may be divided, when thread-like, but when extensive their division would run the risk of injuring the bowel. *Omental* adhesions may be divided a little more freely, or a small portion of omentum may even be left adherent to the neck of the sac.

With a *gangrenous state* of the intestine and omentum; the state of the *bowel* will determine the propriety of its reduction, or of the formation of an artificial anus. Gangrene short of sphacelus is not irrecoverable, and this more favourable condition is indicated by the bowel, however approaching to black, still retaining its peritoneal lustre. In this state, the bowel may be returned just into the abdomen; where it will perhaps recover itself; or in the event of sloughing, the aperture may be closed by peritoneal adhesion, and the slough pass into the intestinal canal without fecal extravasation; or the feces and slough will escape through the wound, as the most unfavourable issue. Mr. Aston Key advocated this procedure. *Sphacelus* is of course irrecoverable, and the only difference of opinion is as to the propriety of dividing the stricture. Division has been said to be unnecessary or even injurious, and such was the opinion of Travers and Lawrence; on the other hand, division of the stricture was advocated by Dupuytren, Sir A. Cooper, and Key; but also that the bowel should not be returned, and a free incision made into it to allow the discharge of feces through the wound. If the gut has already broken, a similar proceeding will be appropriate; division of the stricture, and the bowel left unreduced in the sac. In both these states of sphacelus, adhesions, consequent on peritonitis, form around the stricture at the neck of the sac; and thus retaining the bowel in position and preventing feculent extravasation backwards into the peritoneal cavity, an artificial anus becomes established.

The state of the *omentum*, and the quantity of it protruded; will determine with regard to this structure the propriety of its reduction, or of leaving it in the sac, or removing it. Gangrenous omentum should certainly not be returned into the abdomen; and inflamed omentum with extensive adhesions is equally unfit for reduction. But a large mass of protruded omentum, or an omental protrusion which has become hypertrophied, indurated, or otherwise changed in structure, as in old herniæ; are conditions which, if returned, would excite peritonitis. The omentum must either be left in the sac, or removed. If left in the sac, the advantage and disadvantage are these. Usually, the omentum shrinks up, and eventually the wound heals, but with more or less of a tumour remaining at the hernial aperture; a condition which may prove useful in plugging up the aperture, although it will interfere with the efficient application of the pad of a truss. Or, the omentum is liable to become inflamed, to suppurate and slough; delaying considerably the healing of the wound. Removal of the omentum therefore seems a justifiable resource, as compared with the results of leaving it. *Ligature* of the mass is always necessary; both to prevent the risk of hæmorrhage from the highly vascular omentum, and the peril of extravasation backward into the peritoneal cavity, beyond the reach of surgical interference and which would be provocative of peritonitis. The mass may be ligatured by means of a single ligature of whipcord, tied tightly round the neck; or the omentum may be ligatured in successive portions, so as to tie the vessels separately. The one proceeding was formerly supposed to have the disadvantage of inducing peritonitis by contraction of the omentum; an evil consequence which has, however, been disproved by the results of



more recent experience, particularly in the practice of Mr. Pollock, Mr. Erichsen, and Mr. Holmes. Of 20 cases of hernia, at St. George's Hospital, in which the omentum was securely tied, a few died; but post-mortem examination showed the cause of death to have been, in all cases, independent of the ligature. But, ligature of the vessels singly has the advantage of more surely preventing hæmorrhage, when the ligatures become detached. In my own practice, I distinctly lost a patient owing to the uncontrollable hæmorrhage arising from the separation of a single ligature around the omentum *en masse*. Ligatured omentum may be *left* in the sac, or removed by *excision*. Of 11 cases, at St. George's Hospital, in which the omentum was allowed to remain, many recovered, although abscess and sloughing of its tissue occurred in some of them. Excision should be performed close to the external aperture; care being taken to leave the stump of omentum in the aperture, and to secure it there by fixing the ligature cords with a strip of plaster on the adjoining part of the abdomen. The stump thus occupying the orifice, is free in the event of hæmorrhage, and it forms a plug which permanently obstructs the descent of a hernia, and which is quite as effectual as when the whole mass is left. Ligature and excision of the omentum must always be very carefully performed; before applying the ligature, the omentum should be unfolded to see that it does not envelope a knuckle of intestine, and in using the knife, care must be taken not to touch the bowel.

The formation of a regular "omental sac" around the intestine, is described by Mr. Prescott Hewett, in the Med.-Chir. Trans. of 1844, and in the Path. Trans., vol. iii.

*Cysts* containing serous fluid or blood, are occasionally met with in the omentum; they resemble a knuckle of intestine. Their nature having been ascertained, the fluid may be discharged by puncture. The omentum is then managed according to the rules already laid down.

*Accidents in the Operation.*—*Wound of the intestine* happens occasionally; this accident occurred in the skilled hands of Sir A. Cooper, and in those of Sir W. Lawrence, Mr. Liston, Cloquet, and Jobert. It is liable to happen in either stage of the operation; in opening the sac, or in dividing the stricture. The one occasion of accident may generally be avoided by observing the precautions enjoined, in opening the sac; and the other by equally protecting the gut, in dividing the stricture. The escape of flatus and fæces will at once declare the nature of the accident; although of course the same discharge occurs when the gut yields by laceration from handling it in a softened and gangrenous state.

The *treatment* of wounded intestine is simple. A puncture may be secured by seizing the point with forceps, and casting a fine silk ligature around it, the ends of which should be clipped off close. An incision may be closed by the Glover's stitch. In either case, the bowel is then to be returned just inside the mouth of the sac. The case proceeds the same as in a wound of the abdominal parietes involving the intestine; and the result is not unfrequently successful, or the bowel giving way, an artificial anus forms.

*Wound of an artery.*—In dividing the stricture, an artery may be wounded; either as a sheer accident, owing to some anomalous course of the vessel; or from dividing the stricture in a wrong direction. The accident is more liable to happen to the deep epigastric or the obturator arteries, in the operations for inguinal and femoral herniæ.

*Treatment* consists in at once cutting down upon and securing the

bleeding vessel; an injunction easier given than carried out. As a precaution against such an accident under any uncertain circumstances, Mr. Erichsen recommends that the edge of the hernia-knife should be blunted by drawing it over the back of a scalpel; when it will still be keen enough to relieve the strangulation, whilst it will push before it any artery that may happen to lie in the way.

*Sloughing of the sac* rarely ensues after operation; it commonly terminates fatally, occasionally in recovery.

(b) *Operation without opening the sac*.—This modification of the operation for strangulated hernia is performed in precisely the same manner, short of opening the sac. The circumstances under which this limited operation would be advisable, have been already enumerated. The stricture is divided externally, by means of a probe-pointed bistoury; and the contents of the sac reduced by compression. In fact, the taxis is reapplied to the sac, now that the stricture is divided. That failing, there is no alternative but to open the sac, and complete the operation in the usual manner.

*Either modification* of the operation (*a* or *b*) for strangulated hernia is concluded, by bringing the line of incision in the integument together by two or three points of suture and strips of plaster; over which a pad-compress of lint should be applied, secured by a bandage, to prevent any re-descent of the hernia. It is well, however, to leave the lower angle of the wound open, to allow of the escape of bloody-serous fluid. When the sac is left occupied, and it is sought to establish an artificial anus, or such an opening has formed; the wound must be allowed to remain open.

*Treatment after operation*.—The general indications are; to restore the healthy state of the intestine and omentum, and to prevent or manage inflammation supervening as peritonitis,—and as complicated with a penetrating wound of the abdomen and a reduced state of the constitutional powers, in consequence of continual vomiting, starvation, suffering and alarm.

Two principles of treatment have been adduced, of opposite character; and both having been advocated by Surgeons of the highest eminence, they each demand notice.

In the one class are those Surgeons who administer purgatives almost immediately after the operation, and persist in their continuance “until the intestinal canal is completely unloaded.” Calomel, castor oil, extract of colocynth, and sulphate of magnesia, are administered by the mouth, and enemata per rectum.

Another—and as I think, a far more judicious class of practitioners, relying on the restorative power of nature,—the strangulation having been relieved—have but little recourse to medicine. Care is taken to leave the intestine at rest for some days to recover itself, and that the diet be light and unirritating, in the shape of farinaceous food and milk; while opium is had recourse to as occasion may require. Accordingly, this plan of treatment may be generally stated in the following order. The patient is placed on his back in bed, and not disturbed by talkative friends. Soon after the operation, a full dose of opium—thirty drops of the tincture, will be advisable. At this period, brandy-and-water may be given with advantage, in small quantities at intervals, as a stimulant; to recover the circulation from the state of prostration or collapse previous to the operation, and the effect of chloroform. The *bowels* will probably be

relieved naturally within the first twenty-four hours. But if not, they may be allowed to remain inactive for three or four days, when a mild enema of gruel and castor oil or salt and water, will be sufficiently laxative. Great distension and discomfort may justify relief at an earlier period; but cases not unfrequently proceed even to the healing of the wound without any intestinal action, and no evil consequence from the constipation. The diet, light and unirritating, must be given in small quantities at short intervals; the object being, the support necessary for reparation without loading the intestine. Thirst, often a distressing symptom, will be greatly allayed by sucking pieces of ice in the mouth.

*Peritonitis* supervening, is denoted by the usual symptoms of pain in the neck of the sac, spreading over the abdomen; this must be met by leeches, warm fomentations, and the ordinary treatment of peritoneal inflammation; in its acute and sthenic, or its chronic and asthenic forms. This plan of treatment must, therefore, be modified according to the opposite conditions of youth and age, strength and decrepitude, temperance and intemperance, and the peculiarities of health and disease.

The *wound* may heal partially or entirely by primary adhesion. But if inflammation and suppuration ensue, the sutures should be withdrawn, here or there, to allow of the free escape of discharge. Healing then takes place by granulation and cicatrization. When the patient gets up, he should wear a truss for some time, to support the part as yet in a weakened state. It may be disused, when there is no tendency to protrusion on coughing or other exertion.

The *prognosis* of strangulated hernia, in regard to the *mortality* after operation, will be determined; partly by the relative statistical results of operation with reference to the sac, as already shown; but partly and principally by consideration of the previous duration of strangulation, and the taxis to which the tumour has been subjected. The influence of strangulation has been shown by Luke's statistics, as to the results of operation for Strangulated Hernia.

Of 20 fatal cases operated on by Mr. Birkett in Guy's Hospital, the *periods of survival* were as follow:—

1	survived only 17 hours.
5	„ 24 hours, and less than 48 hours
4	„ 48 „ „ „ 72 „
1	„ 72 „ „ „ 96 „
1	„ 96 „ „ „ 120 „
3	„ 144 „ „ „ 168 „
1	„ 168 „ „ „ 192 „

3 survived longer periods, but with artificial anus.

1 died of bronchitis.

The causes of death were:—

Artificial anus, &c. . . . .	3	Perforation of bowel . . .	1
Prostration . . . . .	5	Bronchitis and cachexia . .	2
Acute peritonitis . . . . .	8	Neglect to seek surgical aid	1

Two-thirds, at least, of these patients lost their lives by the previous delay of operation for the liberation of the bowel; although this was done as soon as possible after admission to Hospital.

**ARTIFICIAL ANUS.**—This condition is said to exist whenever an aperture forms, or is made, in the intestine, through which its contents escape externally. The state of the bowel is, usually, gangrenous; whereby it



may have yielded in the sac before operation, or afterwards although returned into the abdomen; or it may be purposely laid open in the operation, to allow of the escape of fæces when that issue is inevitable. A healthy portion of intestine may, however, be accidentally wounded, in the course of operation, or by a penetrating wound of the abdomen. Artificial anus occurs most frequently in the inguinal, scrotal, and femoral regions; and in connexion with the small intestine. The kind of discharge will depend on the part of the gut opened, and its quantity on the size of the aperture. Whatever discharge there be, it is involuntary, and usually continuous.

Artificial anus differs according to the *extent* of aperture; as a sloughing perforation in the bowel, or sloughing of the entire circumference of the canal. Sloughing perforation usually occurs about the centre of the convex free-border of the knuckle of intestine,—at a point most distant from the mouth of the sac; a small ulcerated opening is produced, which does not interfere with the continuity of the intestinal canal, although allowing a portion of its contents to escape. This condition is sometimes distinguished as *fecal fistula*. Sloughing of the entire circumference of the intestine usually occurs at the mouth of the sac; the continuity of the canal is destroyed, and all the feculent matter escapes through the opening. The coats of the bowel are endowed with different powers of resistance to the process of ulceration whereby the slough is detached. Thus, by constriction of the bowel, a sulcus or groove is produced on its serous surface, without any trace of abrasion; but the mucous membrane presents a circular line of ulceration. This is sometimes limited to the upper and distended end of the intestine; the lower end, corresponding to the stricture, being unaffected. This difference may be owing to pressure of the distended bowel, and it occurs particularly where the knuckle of intestine lies in close relation with Gimbernat's ligament. Very rarely, as the result of long-continued constriction, and the pressure upon two portions of intestine laterally, their walls become adherent; ulceration takes place, and the continuity of the canal is thus naturally restored within the abdomen. An illustrative case is recorded in the Trans. Path. Soc., vol. x.

Intermediate conditions, between these two extremes, are met with; in which more or less of the circumference of the tube is destroyed, and a corresponding opening produced.

In the first condition referred to, repair frequently takes place; the hole closes, the integument heals, and complete recovery ensues.

In the second condition frequently, an artificial anus is at length established; and which never, or very rarely, undergoes spontaneous cure. Its completion is as follows:—The margin of the intestinal aperture—whether the whole or a portion only of the calibre of the intestine—becomes firmly adherent to the abdominal peritoneum; the openings of the upper and lower end of the canal are, at first, equal in size and lie almost in a continuous line. Subsequently, they unite at a more or less acute angle, presenting an intermediate spur-like portion or partition, of double-walled gut, opposite the mesenteric attachment, and bisecting the aperture externally. Of these two openings thus leading into the canal; the distal one, gradually ceasing to transmit fæces, becomes smaller; whilst the cardiac end, doing double duty, becomes dilated. The partition elongating, and acting as a valve, tends also to obstruct the intestinal passage of fæces; and thence the relative size of the two openings is still further exaggerated. Around the general aperture, the mucous mem-

brane sometimes acquires an everted, pouting appearance, or an actual prolapsus of the membrane may take place; while the surrounding skin usually is irritated and excoriated by the feculent matter escaping. The communication between the bowel and integument may not be *immediate*,—through the adhesive junction of the mucous membrane and skin; they may even be placed at some distance apart, a channel intervening between two apertures, internal and external. This modification of artificial anus occurs when the knuckle of intestine is lodged deeply; as in the neck of the sac, or within the abdominal cavity when an irrecoverable portion of intestine has been returned. In the latter case, fecal matter begins to issue, a few days after operation, and gradually increases in quantity; until, from merely staining the dressing, the nature of the communication is plainly declared.

*Treatment.*—This will depend on the size of the aperture. A *small* opening—a fecal fistula, may contract and close, by cleanliness and the pressure of a pad to restrain the discharge. This result may also be induced by the occasional introduction of a red-hot wire, or of the galvanic cautery. Closure can be directly effected sometimes by a plastic operation; by engrafting a small piece of skin over the aperture, or by making an oval incision on either side and bringing the outer edges of the incisions together by means of fine needles and twisted suture.

A *large* aperture, and fairly *established* artificial anus, will very rarely contract and close, but requires a special surgical operation to effect a cure. The object is twofold; to destroy or diminish the spur-like partition, in order to re-establish the continuity of the intestinal canal, and then to close the external aperture. The destructive part of this proceeding may, perhaps, be accomplished by repressing the septum, as Desault proposed, by means of a tent thrust into both intestinal openings. It can be more surely accomplished, and with equal safety provided due caution be observed, by strangling the septum; for which purpose Dupuytren's enterotome is admirably adapted. This instrument is simply a serrated forceps, worked by a screw across the end of its handle. The septum is grasped and compressed between the blades, and the pressure gradually increased by daily turning the screw, until the blades meet and the intervening septum has sloughed away. Plastic lymph is thrown out simultaneously, whereby the peritoneum should remain unopened, when the instrument is withdrawn. Hence the caution necessary, not to grasp the septum too high up towards the mesentery, and to regulate the compression in concert with the plastic effusion. The continuity of the canal having been re-established, the margin of the external anal aperture must be pared and brought together by hare-lip sutures.

A *permanent* artificial anus sometimes remains, having resisted all attempts at closure. This sad state may be made more tolerable by wearing a leathern receptacle or other contrivance; and it is gratifying to add, that patients have thus been enabled to live in comfort and the enjoyment of good general health for many years. An artificial anus situated high up in connexion with the intestine, and which discharges chyle or chyme, will of course constantly deprive the patient of nutriment; and this loss must be supplied by a proportionately increased quantity of nourishing food.

**DOUBLE HERNIA.**—A protrusion on both sides of the body, symmetrically, in the same parts, or unsymmetrically, in different regions, not unfrequently occurs. More than two such herniæ are occasionally met

with; and Sir A. Cooper records a case of six co-existing herniæ in the same person; three on one side, an inguinal oblique, a direct, and a femoral hernia, with the same on the other side. In any such case, symptoms of strangulation may be referable to this hernia or to that, and it is sometimes very difficult to determine which is the seat of strangulation. Hence, in double hernia, the operation may be performed on that side which when the sac is open presents no appearance of being strangulated. What should then be done? The Surgeon is justified in operating on the other side, with the view of saving the life of his patient. An illustrative case of double operation in double inguinal hernia, and a successful result, happened in the practice of Dupuytren; and it may be referred to as a precedent under similar circumstances. The case is related in the *Leçons Orales*, 1832, tome i. p. 583.

## CHAPTER LIII.

### SPECIAL HERNIÆ.

**INGUINAL HERNIA.**—*Structural conditions.*—Inguinal hernia is that form in which the visceral protrusion occupies part or the whole of the inguinal canal,—presenting an *incomplete* hernia or *bubonocoele*; or passing through the external abdominal ring, it becomes a *complete* or *scrotal* hernia, sometimes named *oscheocoele*. In the female, it passes into the labium. The hernia occurs in two principal varieties, as to its direction and relation to the deep (internal) epigastric artery; and which are designated accordingly, the *oblique* or *external* inguinal hernia, and the *direct* or *internal* inguinal hernia. Thus, in point of direction, the hernia may take place through the internal abdominal ring and follow the oblique course of the spermatic cord in the inguinal canal, thence perhaps passing through the external ring and into the scrotum; or, the protrusion may come directly through the conjoined tendon of the internal oblique and transversalis muscles, into the canal, just behind the external abdominal ring, thence perhaps passing through that ring into the scrotum. With relation to the epigastric artery; in the oblique variety, the mouth of the sac is external; in the direct variety, it is internal to that vessel. Oblique inguinal hernia is named *congenital*, when the visceral protrusion lies within the tunica vaginalis, as its sac, in contact with the testicle; and *infantile* hernia, when the protrusion carrying before it a peritoneal sac, lies just behind and dips into the tunica vaginalis as an independent sac—constituting what is also termed *encysted* hernia.

There are, then, three varieties of inguinal hernia; oblique or external, direct or internal; congenital, and its sub-variety, infantile or encysted.

**OBLIQUE INGUINAL HERNIA.**—*Course.*—This is the most common form of inguinal hernia. Its course is the same as that of the testicle in its passage from the internal abdominal ring through the inguinal canal and external ring into the scrotum; this route corresponding also to the spermatic cord in the same extent of its course.

*Anatomical coverings, and relations.*—The coverings of oblique inguinal hernia consist of those layers of different textures which successively invest the protrusion, in its formation and progress. They are the same investments that the spermatic cord receives,—seven in number, and they



may be conveniently enumerated from within, outwards, in the order of hernial development, as follow; peritoneal pouch forming the sac of the hernia, its sub-serous cellular tissue, and the fascia transversalis abdominis or infundibuliform fascia (Fig. 397); cremasteric fascia, consisting of

FIG. 397.\*



looped fibres of cremaster muscle proceeding from the internal oblique, with interstitial cellular texture; intercolumnar or spermatic fascia, consisting of tendinous semicircular fibres passing across between the pillars of the external abdominal ring, and thence prolonged downwards from the upper margin of the ring; superficial fascia, containing fat; and skin. These anatomical coverings are interesting with reference to the development of oblique inguinal hernia; but they become so altered in appearance and united by pressure, as to have much less importance surgically.

The relations of the inguinal canal, spermatic cord and testicle, to the visceral protrusion, and of the deep epigastric artery to the mouth of the sac, are specially important.

The *inguinal canal* is the interval between the abdominal parietes, just above the inner half of Poupart's ligament; it extends obliquely down-

\* *a*, external oblique muscle reflected. *bb*, internal oblique, arching over and covering the internal abdominal ring. *c*, transversalis muscle. *d*, conjoint tendon. *e*, rectus muscle, sheath opened. *f*, fascia transversalis. *g*, triangular aponeurosis of conjoint tendon. *h*, cremaster. *i*, infundibuliform fascia. (John Wood.)

wards and inwards, about one inch and a half in length, from the internal abdominal ring to the external abdominal ring at the crest of the pubes. Its boundaries, and thence the relations of inguinal hernia in the canal, are thus formed:—anteriorly by both abdominal oblique muscles over the outer half-inch of the canal, and the aponeurosis of the external oblique alone, the inner inch; posteriorly, by the fascia transversalis and the conjoined tendon of the internal oblique and transversalis muscles, the fascia extending along the outer half-inch of the canal, corresponding to the internal oblique, and the conjoined tendon, with the fascia transversalis behind it, along the inner inch, corresponding to the aponeurosis of the external oblique. Inferiorly, the floor of the canal is formed by the junction of the fascia transversalis with Poupart's ligament; and superiorly, it is limited only by the apposition of the muscles.

The *cord* lies behind or underneath the hernia, the *testis* below and somewhat behind its lowest part—the fundus, and these two are always distinctly separate. Occasionally, the elements of the cord are dispersed by the hernial descent; the vas deferens lying on one side and the spermatic vessels on the other; and rarely, the cord lies partially or entirely in front of the hernia, the testicle also below being in front. In the latter case sometimes, the elements of the cord are spread out in front of the hernia. The *epigastric artery*, arising from the external iliac about a quarter of an inch above Poupart's ligament, bends inwards and ascends beneath the fascia transversalis, immediately behind and *internal* to the mouth of the sac—at the internal abdominal ring, which is thus placed external. The course of this artery varies, however, with the duration of the hernia, and occasionally owing to an abnormal origin of the vessel. In old-standing hernia, the dragging pressure of the tumour downwards and inwards, curves the artery in that direction towards the outer edge of the rectus muscle; until it may thus be brought internal to the situation of a direct hernia. An *abnormal origin* of the artery occurs comparatively rarely; its position may be shifted upwards on the trunk of the external iliac, from the level of Poupart's ligament, as high as two inches and a half above it; or the vessel may arise from another source,—the obturator; or from below the ligament, being transferred to the superficial or the deep femoral artery.

Of these abnormal sources of the epigastric artery; the first has no relation to the internal abdominal ring; the two latter may have special relation to the crural ring, and therefore to femoral hernia.

*Seat of Stricture.*—Commonly, the stricture is situated at the mouth of the sac, in the internal abdominal ring; next in order of frequency at the border of the internal oblique muscle, in the inguinal canal; lastly, at the external abdominal ring.

**DIRECT INGUINAL HERNIA.**—*Course.*—This variety of inguinal hernia comes forward through a small triangular space, bounded by the epigastric artery *externally*, the margin of the rectus muscle on the inner side, and Poupart's ligament,—its inner portion, below. This space is situated, just behind the external abdominal ring, the conjoined tendon and fascia transversalis intervening.

*Anatomical Coverings, and relations.*—In number the coverings are the same as those of the oblique variety, and in kind they are the same, with one exception; the conjoined tendon is substituted for the cremasteric fascia. Thus, enumerating them in the order of hernial development, the coverings of direct inguinal hernia are; peritoneal pouch or sac, sub-serous

cellular tissue, fascia transversalis, conjoined tendon, sometimes ruptured, intercolumnar fascia, superficial fascia, skin. The *spermatic cord* lies on the outer side of the sac, the testicle below the fundus, and both are distinctly separate; the epigastric artery also courses up *external* to the mouth of the sac, curving over it inwards, so as sometimes to embrace the upper as well as the outer margin.

*Seat of Stricture.*—Commonly, the stricture is situated at the mouth of the sac; next in frequency at the conjoined tendon, when ruptured; lastly, at the external abdominal ring.

In the *female*, the anatomy of Inguinal hernia, oblique and direct, is essentially the same as in the male; except that the round ligament in the inguinal canal takes the place of the spermatic cord. Females are liable to both forms of inguinal hernia, the oblique occurring at very early periods of life. Excepting umbilical hernia, oblique-inguinal is the only kind developed before five years of age; and until the age of puberty, it is more common than any other variety of hernia. This form is not much more rarely met with than femoral, as generally supposed. Thus, in 1582 females, affected with hernia, in one form or the other, who came under Mr. Kingdon's observation; 761 had inguinal hernia, and 812 femoral hernia. Or, the one was only 30 less than half the total number, whilst the other was only 30 more than half that number.

*Signs of ordinary Inguinal Hernia.*—The *oblique* variety commences as a slight fullness or swelling at the internal abdominal ring, just above the centre of Poupart's ligament, next, passing downwards and inwards in the inguinal canal, it presents an oblong tumour having that direction, in this situation. (Fig. 338.) Still further protruding through the external

FIG. 338.



abdominal ring and descending into the scrotum, or the labium in the female, the tumour enlarges into a globular form on that side. It may attain an enormous size, extending down even to the knee, as in cases to which I have already referred; and a far smaller size in women. But—in males—the testicle can always be felt distinct, at the bottom and back part of the fundus. The usual symptoms of hernia are perceptible; enlargement and impulse on coughing in the erect attitude, diminution and disappearance of the tumour when compressed in the recumbent position. These symptoms are, however, more or less perceptible, according to the size of the hernial protrusion; being less so when it occupies the inguinal



canal, as *bubonocoele*, and most conspicuous in *scrotal* hernia. In old-standing oblique hernia, the neck of the sac is dragged downwards and increases towards the middle line; so that the distinctive shape of the inguinal portion is lost, and the tumour comes to resemble the next form of inguinal hernia.

*Direct* Inguinal hernia presents a tumour, which differs in situation, and somewhat in shape, and size, from that of the oblique hernia. This direct variety is situated at the external abdominal ring, near the root of the penis, the outer portion of the inguinal canal remaining unoccupied; the tumour is more globular, not pyriform as in the oblique, and it has a wider neck; usually, it is not so large. The other symptoms are similar.

Both varieties of inguinal hernia may co-exist in the same individual; or double inguinal hernia, one on either side, is occasionally met with. Not unfrequently, the hernia on one side is incomplete,—a *bubonocoele*, on the opposite side to an ordinary complete inguinal hernia,—a *scrotal* hernia.

CONGENITAL HERNIA.—This variety of oblique inguinal hernia was first noticed by Haller in 1749, and its nature was more particularly described by John Hunter and Percival Pott. The peculiar structural condition is this; the visceral protrusion lies in the tunica vaginalis, with, and in contact with, the testicle; when that organ has previously descended from the abdomen into the scrotum.

The course, coverings, and relations of the hernia are the same as those of the ordinary oblique; except that the *sac* is the tunica vaginalis, and the relation of the *testis* is immediate, it being within the sac, although the situation of that body below and somewhat behind the hernial contents—not the fundus of the sac—remains unaltered. The visceral protrusion passes down from the abdomen, through the vaginal process of peritoneum which connects the peritoneal cavity with the tunica vaginalis; this process having remained unobliterated after birth, instead of closing as usual in about three weeks or a month. Paletta states that, normally, the complete closure of the vaginal canal takes place from the twentieth to the thirtieth day after birth. But, when the canal remains pervious, although the tendency to this hernia thus dates from birth, it may not occur for years afterwards. Hence the hernia itself is not properly speaking congenital, and it might be more correctly designated, as Mr. Birkett has suggested, “hernia into the vaginal process of the peritoneum.” Occurring, therefore, in early life,—in infants a few weeks or months old; congenital hernia also occurs, for the first time, at perhaps any subsequent period of life. Instances between the ages of eighteen and twenty-five are related by Velpeau; and two by Erichsen, at twelve years old and thirty years of age. In both the latter cases Mr. Erichsen operated at the ages respectively of thirty-five, and fifty; and I once operated on a right congenital hernia in a middle-aged man, in whom after death, unfortunately, I found the left vaginal process completely pervious, admitting a large-sized elastic catheter from the internal abdominal ring to the testicle. Thus this was a case in the adult of strangulated congenital hernia on one side, and the persistent structural condition without hernia on the other side. The preparation is in the Museum of the Hospital.

The relation of the *testicle* to congenital hernia is very important; associated with congenital persistence of the vaginal process of perito-

neum, the testis on the same side frequently occupies an abnormal situation. There will then be two persistent congenital conditions, both arrests of development; the one, an unobliterated state of the vaginal process of peritoneum, which should be temporarily provided only as a sheath for the descent of the testicle into the scrotum; the other, an arrested descent of the testicle. Congenital hernia may, therefore, not as usual contain the testicle in the hernia vaginalis or hernial sac, the testis never having descended into the scrotum.

*Abnormal situations of an undescended testis*, and accompanying conditions of the vaginal process. These modifications are as follow:—

(1) *Testicle* within the abdomen; the vaginal process extending into the inguinal canal, but not reaching further than just through the external abdominal ring, or into the upper part of the scrotum. (2) Fixed in the inguinal canal out of the reach of manipulation; whilst the serous canal, passing into the scrotum, forms a sac for the reception of a hernia. (3) Immediately outside the external abdominal ring at the upper part of the scrotum; in which state, when a hernia descends, it passes in front of the testis into the scrotum, even as low as its fundus. A defective development of one or even both sides of the scrotum is associated with these otherwise defective conditions; and thus the Surgeon may be led to discover an abnormal position of the testis, a matter of great importance as to the appropriate treatment of any such modification of congenital hernia—*i.e.*, inguinal or scrotal herniæ, with *undescended testicle*.

The *abnormal conditions of the vaginal process* of peritoneum, in connexion with the abnormal situation of the *testicle*, and the relative position of the *hernia* to this organ; may be thus tabulated:—

(1) The vaginal process continuing open and common to the cord and testis.

The testis may be situated—

- a. in its normal site at the fundus of the scrotum;
- b. just outside the external abdominal ring, or between its pillars;
- c. within the inguinal canal;
- d. within the abdomen.

N.B. In *a*, *b*, *c*, the hernia is generally in contact with the testis; in *d*, it is not.

(2) The vaginal process of the cord and testis communicating by an intermediate aperture.

The testis in the scrotum.

N.B. The hernia may or may not pass through this aperture, and is therefore sometimes but not always in contact with the testis.

(3) The vaginal process of the cord only being open—Hernia into the funicular portion of the vaginal process. So named by Birkett, this condition was first described by M. Malgaigne.

The testis in the scrotum.

N.B. The hernia is never in contact with the testis.

*Additional sacs*, or prolongations and extensions of the vaginal process within the abdominal walls;—"intra-parietal," "inter-muscular," "interstitial, hernial sacs;" "*hernie-embissac*" of French authors. Concurrent with misplaced testis there may be an abnormal disposition of the hernial sac, itself abnormal. An offset from the vaginal process of peritoneum, forming a second sac, may extend into the substance of the abdominal wall. The hernial sac will thus consist of two parts; that division which passes along the inguinal canal into the scrotum, and that





In congenital hernia, scrotal or inguinal, with *undescended* testicle; the absence of this organ from its normal situation will declare the nature of the hernia. The testis may be found just outside the external abdominal ring or between its pillars; within the inguinal canal; or within the abdomen. Still, in the first two modifications of congenital hernia, the hernia is generally in contact with the testis; in the last named it is not so. An *inflamed* undescended testicle simulates the symptoms of strangulated hernia; thus obscuring the diagnosis of these two conditions,—orchitis and congenital hernia presumably strangulated. In the inguinal canal; the tumour, having an oblong shape, may be tense and painful, with some abdominal tenderness emanating from that situation, and there may be perhaps nausea and constipation. But if it be the orchitis of a misplaced testicle, these symptoms subside after a while, and especially the constitutional disturbance; leaving only a tumour of diminished size, the testicle, in the inguinal canal. And the absence of this organ from the scrotum will have suggested, in the first instance, the probable nature of the case. I remember, when a student, having seen such a case under the care of Mr. Erichsen, soon after he joined the University College Hospital. In any case of supposed congenital or infantile hernia, the duration of the tumour from childhood, in some instances, will throw some light on the question of diagnosis.

*Encysted* hernia presents no distinctive characters from congenital hernia; but the testicle can be felt distinct from the hernial contents, at the bottom of the scrotum. The precise nature of the hernial tumour is, however, usually discovered only during an operation, when requisite for the relief of strangulation.

DIAGNOSIS OF INGUINAL HERNIA.—Every inguinal hernia escapes from the abdomen above Poupart's ligament.

*Femoral hernia* is distinguished as follows. When inguinal hernia is confined to the inguinal canal—as an incomplete hernia or *bubonocoele*, Poupart's ligament can always be traced along its inferior border, and the hernial aperture is situated above this ligament. Thus the tumour is distinguished from femoral hernia, which is situated below the ligament, and this band can always be traced along the superior border of the tumour. When the hernia has become *scrotal*, it will have escaped through the external abdominal ring, the outer pillar of which is attached to the spinous process of the pubes. Placing the point of the finger on this process; if the neck of the tumour lies internally—between the finger and the symphysis pubis, the protrusion must have passed through the external abdominal ring, a demonstration of its being of inguinal origin. A hernial tumour situated to the outer side of the finger, will probably have passed through the crural ring, and thus be a femoral hernia.

*Chronic tumours* in the inguinal region and scrotum respectively, may, with regard to their diagnosis from inguino-scrotal hernia, be divided into two classes; reducible and irreducible tumours.

*Reducible* tumours are; (1) inguinal hernia, (2) hydrocele of the vaginal process of the p.-ritoneum, (3) hydrocele of the funicular portion of the same process, (4) varicocele of the spermatic veins.

*Irreducible* tumours may be either fluid or solid, or mixed solid and fluid. The fluid are; (1) hydrocele of the tunica vaginalis propria testis, (2) hæmatocele in the same sac when first developed, (3) encysted spermatocele connected with the epididymis, (4) hydrocele of the spermatic cord. The solid, or solid and fluid, are; (1) diseases of the testis (a) of

inflammatory origin, (b) specific new growths; (2) old hæmatocele, (3) diseases of the spermatic cord, (4) growths of fat extending from the inguinal canal into the scrotum, (5) diseases of the tissues of the scrotum. All these diseases, presenting swellings or tumours, are described in other parts of this work; it will here suffice to notice their points of difference from inguino-scrotal hernia, which may be conveniently exhibited in a tabular form.

THE REDUCIBLE TUMOURS.	
<i>Their entrance or return into the abdomen.</i>	
	<div>Characters in common.</div> <div>Special Characters, when uncomplicated.</div>
1. Inguinal Hernia.	<p><i>All</i> return into the abdomen most easily when the patient lies recumbent, and the abdominal muscles are relaxed.</p> <p>1. <i>Hernia</i> enters most readily. When once commenced, passes in quickly and suddenly. Entrance complete. Thick and opaque neck of tumour. Testis may or may not be perceptible until reduced. <i>No</i> vibration.</p>
2. Hydrocele of vaginal Process of Peritoneum.	<p>2. <i>Hydrocele</i> of vaginal process of peritoneum enters slowly, and never suddenly. Entrance complete. Narrow and translucent neck of tumour. Testis imperceptible until the fluid has entered the abdomen. Vibration.</p> <p><i>Their Passage from the Abdomen.</i></p> <p><i>Special Characters.</i></p> <p>1. Is developed from above, descends when the patient rises or exerts the abdominal muscles, and more quickly than others. Pressure over the ring prevents its descent.</p> <p>2. Seems to be developed from below upwards. The serous fluid sometimes remains when patient is recumbent.</p> <p>3. Similar to No. 2.</p>
3. Hydrocele of funicular portion of vaginal process of peritoneum.	<p>3. <i>Hydrocele</i> of funicular portion of vaginal process enters like No. 2. Entrance complete. Translucent. Neck of tumour may pass into inguinal canal. Testis perceptible at fundus of tumour. Vibration.</p>
4. Varicocele.	<p>4. Varicocele enters very slowly. Entrance not complete, the bulk of tumour only diminished. <i>No</i> vibration.</p> <p>4. The tumour increases like hernia when the patient rises; but it increases also if pressure be made over the course of the spermatic veins in the inguinal canal, or by retardation of the blood however caused.</p>

## THE IRREDUCIBLE TUMOURS.

<i>Disease.</i>	<i>Weight.</i>	<i>Translucency.</i>	<i>Fluctuation and Vibration.</i>	<i>Relation of Testis to Tumour.</i>	<i>Figure and Development.</i>	<i>Size.</i>	<i>Consistence.</i>	<i>Pain.</i>
<b>Hernia.</b>	Lighter than either the fluid or solid tumours.	Very rarely so; generally opaque.	Only when fluid co-exists with the hernia.	Position variable, but the testis usually discoverable.	Pyiform, but with thick neck. Occasionally globular or ovoid. Outline regular. Begins at neck of scrotum and descends.	Variable; at times very large.	Soft and yielding, except it be omental.	Painless unless eased.
<b>Fluid Tumours.</b>	Hæmatocele rather heavier than hydrocele.	Hydrocele particularly so. In rare cases opaque. Hæmatocele opaque.	Distinct vibration very characteristic as in hydrocele.	Perceptible in spermatocele; not in hydrocele of tunica vaginalis propria testis, usually.	Pyiform, but with very thin neck. Outline very regular. Globular as hydrocele of spermatic cord. Oblong as in spermatocele, and nearly transverse to vertical axis of scrotum. Begin near fundus of scrotum and ascend.	Rarely very large.	Yielding and elastic. Exceedingly incompressible as hydrocele of cord.	Painless unless testis be squeezed, usually.
<b>Solid Tumours.</b>	Generally heavier than fluid.	Opaque.	Absent.	Often involved and imperceptible, though its site may be discoverable by pressure.	Outline of testis often preserved. Sometimes surface irregular.	Large; steadily increasing.	Resisting, firm, and rarely hard.	Painful, but varying in degree.
<b>Mixed Tumours.</b>	Heavy.	Sometimes in parts of them.	In some parts, not in others.	Involved.	Irregular Outline.	Large; at times rapidly increasing.	Resisting in parts, soft in others.	Variable.



**TREATMENT.**—Inguinal hernia, in common with other herniæ, requires different treatment according to whether it be reducible, irreducible, or strangulated; besides which there is the special adaptation of treatment to the special varieties known as congenital and encysted herniæ.

*Reducible hernia* should be returned, as soon as possible, by employment of the taxis; care being taken that this manipulation of the tumour be conducted gently, in the manner already fully described. The direction of pressure is particularly important; and the terms oblique and direct with regard to inguinal hernia, will sufficiently suggest the course of the hernial protrusion. When reduced, a suitable and well-fitting truss must be applied and worn. The pad must be so adjusted as to fairly close the hernial aperture; in the oblique inguinal, it should press not only upon the external abdominal ring, but also upon the whole length of the anterior wall of the inguinal canal; in the direct inguinal, the external ring only need be closed. Some pain or discomfort, owing to pressure on the spermatic cord, may require a little readjustment of the truss.

*Inguinal hernia Trusses.*—Various forms of Truss have been invented, and used, for Inguinal hernia. Those which are more commonly employed differ in their construction, and relative advantages, as follow :— (1) Salmon and Ody's truss—Its peculiarities are; (a) the spring extends from the centre of the spine across the abdomen to the abdominal ring—the truss being of formed, that it passes round the opposite half of the body to that on which the hernia occurs. (b) The pad is attached to a ball-and-socket joint, so that it may more accurately follow the movements of the trunk. Fig. 400 represents the *single* truss, of this description; (Fig. 401) the *double* truss, or that for double inguinal hernia.

FIG. 400.

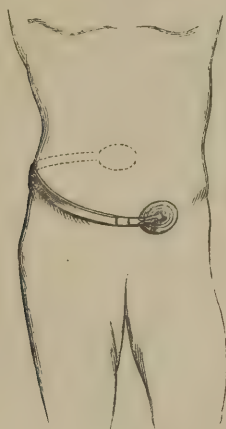
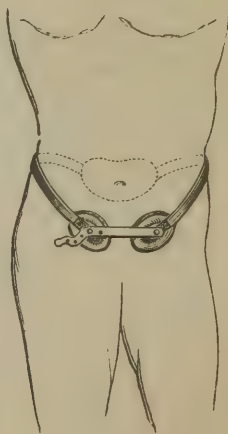


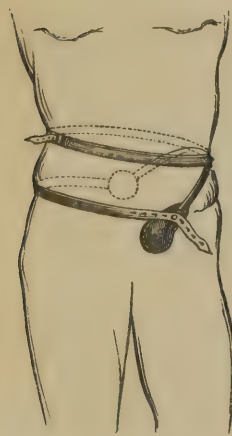
FIG. 401.



Salmon and Ody's truss is a most efficient form of support; I have used it successfully where other inguinal trusses have failed; its special advantage being the *immovable* pad. (2) Coles' truss, differs little from the preceding, in the spring; but it is applied to the side of the body on which the hernia occurs. The speciality of construction, as patented, is, however, in the pad; it is pear-shaped, and contains within it a flat,

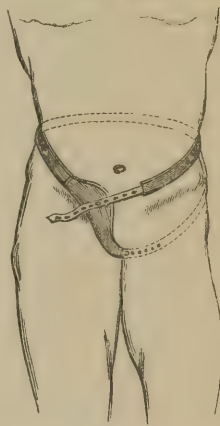
helical spring, which acts as the ball-and-socket joint, but retains the pad more accurately fixed against the internal abdominal ring (Fig. 402). The strap around the waist, as here depicted, is an exception; it having been adjusted, by Mr. Bigg, for a patient with an abscess just above the hip-joint; where the slightest touch could not be borne on the part subject to the pressure of an ordinary Coles' truss. This also is a most efficient truss, especially perhaps for inguinal hernia of *larger* size, where the abdominal rings are more open; but—allowing the more favourable shape of the pad for this special purpose—the action of the helical spring tends to bury the pad and thus dilate the internal abdominal ring—the aperture of protrusion; and, I do not find the pad so freely moveable in accordance with the ever-varying movements of the trunk, in walking, or riding on horseback. (3) Tod's truss, has two peculiarities of construction; a spring which passes *over* the crest of the ilium, and not below it across the buttock—thereby, apparently exercising a more direct control over the internal ring; and, a diminished size of the pad. The former supposed advantage, is, I think, sufficiently provided for by the ball-and-socket joint over the pad—without the specially oblique position of the spring; and, the latter peculiarity, a smaller-sized pad, is a positive disadvantage, by tending to bury itself and thus enlarge the internal ring.

FIG. 402.



(4) The *Moc-Main* truss, is a *lever-truss*, and Bigg's *triple-lever* truss, another of the same kind of instrument; inguinal lever-trusses. The former, consists of a padded leather pelvic band and a large oval pad. But, the pad is stuffed with floss silk, in the midst of which a small metal lever is placed. A thigh-strap is attached by one extremity to this lever, and controls its action when the truss is in use. The advantage of this instrument is its flexibility, whereby it can be worn when necessary to con-

FIG. 403.



control a hernia in the night as well as the day; but, as the sitting-posture loosens the spring by diminishing the tension of the under-strap, the support of this truss is insecure excepting during perfect rest. Bigg's *triple lever-truss*, brings three lines of force to bear on the hernial ring, and is thus specially fitted for exceptional cases of inguinal hernia, which cannot be controlled or supported by previously described trusses.

*Scrotal hernia Truss* presents two peculiarities of construction. It is formed of a padded pelvic spring, as in other trusses, but the pad, instead of being pear-shaped or oval, is *fusiform*; and the lower prolongation is attached to a *perineal* strap (Fig. 403). This strap being carried round the posterior part of the thigh opposite to the rupture, and fastened to the pelvic spring, keeps the pad firmly fixed along the whole length of the inguinal canal; and guards also the external abdominal ring. Thus,

then, both inguinal protrusion, and its continuation as scrotal hernia, are prevented.

On looking at the various forms of Truss, above described; it will be seen that they differ somewhat, in the *pelvic spring*—as to its direction—transverse or oblique; but, the principal peculiarity of each consists in the *pad*—as to its shape, oval, pyriform, fusiform, its immobility, by a ball-and-socket joint or helical spring, and its further adaptation by padding. In regard to this last particular, may also be mentioned other pad materials—the *sand-pad*, and the inflated-pad, with *air* or *water*.

*Radical Cure.*—The ancient or even the less older methods of procedure, now obsolete, may justly be passed over unnoticed. Such were the applications of various ointments, plasters, the actual cautery, caustics; royal stitch, punctum aureum, excision, or ligature, of the sac; ligature of the sac without including the spermatic cord, with or without excision, as practised by Schmucker and Langenbeck; and obliteration of the neck of the sac by the pressure of a strong tight truss, as recommended by Richter and L'Estrange. The modern operations are those of Schuh, Rigg, Belmas, Velpeau, Pancoast, Bonnet, Gerdy and Signoroni, Wurtzer, and John Wood of King's College Hospital. Of these operations it will suffice to notice more particularly those of the last three named authorities; and the following summary of them all is gathered from Mr. Wood's original Treatise on Rupture.

The operations may be classed under two heads. *First*—those which deal with the interior of the *sac only*, with the view of causing *adhesion* of its opposed surfaces to each other; upon the principle of the radical cure of hydrocele. This has been attempted in various ways—namely, by a simple seton of threads, candle-wick, or sponge, passed through the sac by a needle or other instrument. Such are, briefly, the methods practised by Schuh of Vienna, and Riggs of New York. Belmas of Paris, passed into the interior of the sac a bag of goldbeater's skin, which was then distended with jelly to induce irritation of the sac. Velpeau in Paris, and Pancoast in New York, injected into the sac a solution of tincture of iodine or cantharides.

Assuming that these methods of obliterating the sac are without peril to the life of the patient—which for many of them, is a very liberal concession indeed—a simple adhesion of the surfaces of the sac itself, will not prevent the formation of another sac from the abundant and loose peritoneum of the internal opening; the real, effective boundaries of the inguinal canal and rings being left as patulous as before. This was long ago pointed out by Lawrence in his able treatise on Ruptures. With this class may be associated the operative procedure of Bonnet of Lyons, which consists in passing needles across the sac and its coverings; thus pinching them up, as they emerge from the superficial ring. The anterior part only of the sac, and below the inguinal canal, is regarded in this procedure; leaving the upper and posterior portions, and the tendinous boundaries unaffected. The result is the temporary retention of the hernia in the canal, and an ultimate return to its former condition; with the further disadvantage of a constriction or incomplete adhesion, opposite the point operated on, which increases the liability of strangulation. The ultimate condition of the parts was invariably unsatisfactory.

The *second* class of operations are based upon a different principle—*invagination* of the skin and fascia of the scrotum, so as to form a plug up the hernial canal.



*Gerdy's method.*—The skin of the scrotum, containing some portion of the fundus of the hernial sac, is pushed up into the superficial ring upon the finger of the operator. A curved needle, armed with strong ligature thread, is then carried along the finger, and thrust through to the surface of the groin on each side of the point of the finger. The ligature is then tied up, so as to hold the invaginated sac and skin in their new position, till adhesion has taken place in the interior of the canal. Signoroni used a piece of catheter for invaginating; while Gerdy attempted further, to cause adhesion of the opposed surfaces of the hollow cone of skin by removal of the cuticle by caustic ammonia, and by placing sutures at the mouth of the invagination—a proceeding which was usually futile.

*Wurtzer's method.*—In this modification of the operation by invagination, the fore-finger is first introduced to push up the integuments and fundus of the sac through the external abdominal ring and inguinal canal, as high as the internal ring; a box-wood hollow plug is then introduced, as the finger is withdrawn, and a long flexible needle passed along its interior is thrust through the invaginated skin and sac, thence outwards through the anterior wall of the inguinal canal. A grooved piece of wood is then laid over that part, and held in position by the projecting point of the needle at its extremity, while the lower end is fixed by a screw to the plug, so as to compress the invaginated integument and sac. The object is, to distend the inguinal canal and rings by the plug, and to compress by the screw; thus to induce adhesive inflammation between the opposed surfaces of the invaginated integument and sac up to its mouth. In this way by preventing the unfolding of these parts, a permanently inverted cone may result, closing up the hernial canal. Hence the plug is retained for an apparently sufficient period for this purpose, usually about seven days. This procedure, originating with Wurtzer of Bonn in 1838, followed by Rothemund in Munich, and Sigmund in Vienna; was introduced into this country by Mr. Spencer Wells in 1854, and subsequently advocated by Redfern Davies, and others. Mr. Davies suggested that the plug should be made to expand like a glove-stretcher, so that it may fill out the internal ring.

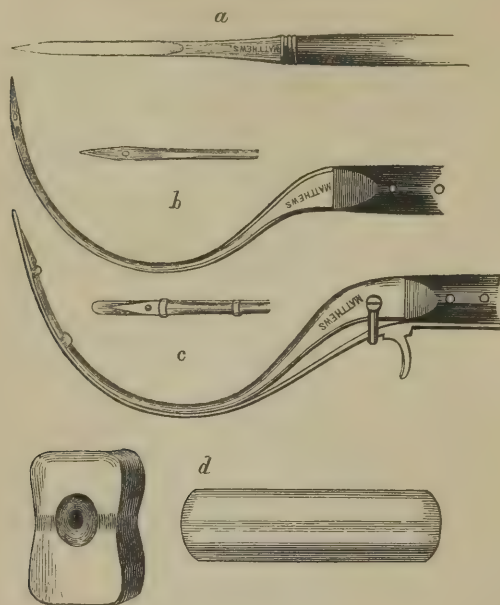
The failure of all these operations is not due to peritonitis; when a fatal result has ensued, it has generally been owing to suppuration and the burrowing of matter between the abdominal layers, and sometimes consequent on pyæmia. But, either mode of operation by invagination commonly proves ineffectual for a complete and permanent cure. In Gerdy's 36 cases, most if not all had a relapse of the hernia. Wurtzer's method seems to have been, from Mr. Wood's inquiries, entirely unsatisfactory in its results. With very few exceptions, the rupture re-descended soon after the plug was withdrawn, or whenever the constant use of a truss was discontinued. A very general impression—he adds—prevails among Surgeons, both in this country, in France, Germany, and the United States, that none of the foregoing operations have given such promise of satisfactory results as to bring them into general use.

*Wood's Operation.*—The novel principle originated by Mr. Wood, for the radical cure of inguinal hernia, consists in the compression and closure of the tendinous sides of the hernial canal throughout its *entire* length; this principle prevailing in the various methods proposed and practised by this author. Thus characterized, they differ entirely both from the older and more modern operations; all of which either deal with the sac

almost solely, or rely upon the principle of dilatation or plugging of the canal. Moreover, unlike that of Schmucker, Langenbeck and others, Wood's operation is of an entirely subcutaneous character. The sac, if punctured at all, is pierced by a small and valvular opening only, and remains deep-seated away from exposure. And the connexions between the sac itself and the layers of deep-seated tissues, are not broken down or interfered with, being traversed only by the needle and ligature.

*Instruments.*—The operation, as practised by Mr. Wood, requires certain instruments (Fig. 404); a small tenotomy-like knife, a stout un-

FIG. 404.



yielding curved needle mounted in a strong handle, a piece of stout copper wire silvered about two feet long, or a stout hempen thread of sufficient length well waxed and then soaped, and a compress of box-wood, glass, or porcelain, long and broad enough to cover the hernial canal. Wire is usually selected, and the operation is performed in the following manner, under the influence of chloroform to relax the abdominal muscles.

The patient lying recumbent with his shoulders well raised, and the pubis and scrotum cleanly shaved; the Surgeon will find it most convenient to stand on the side of operation, and to invaginate with the fore-finger of the right hand on the right side, and *vice versa*. The hernia having been carefully and completely reduced, an assistant should command by pressure, the internal ring, if there be any tendency to protrusion. An incision is then made with the tenotomy-knife, through the skin of the scrotum, over the fundus of the sac, and in direction, obliquely downwards and outwards (Fig. 405); the length of this scrotal incision being sufficient to easily admit the point of the fore-finger with the needle. If the hernia be a bubonocoele, the seat of the scrotal incision should be one and a half

inches below the spine of the pubis. The knife is next turned flatwise between the skin and the fascia, and carried subcutaneously around the edges of the incision, so as to detach the one from the other over an area

FIG. 405.



of at least two inches in diameter; or to a wider extent in a large hernia. Now, the knees of the patient should be brought together and bent up to

relax the inguinal structures; the operator's fore-finger is then passed, with the nail backwards, into the scrotal aperture (Fig. 406), and made to invaginate the detached fascia into the inguinal canal, invagination being commenced at as low a point as possible, so as to force the finger as much as may be behind the hernial sac between its fundus and the spermatic cord, and passed up as high as possible in the canal towards the internal abdominal ring. Hooking the finger well towards the surface, the lower

FIG. 406.



border of the internal oblique muscle will be felt raised upon it (Fig. 407), and more distinctly recognised by placing the other hand upon the surface of the groin. By directing the finger inwards, the conjoined tendon, raised with the muscle, will be felt at the thumb side. The needle unarmed, and oiled, is then passed along the same side of the finger, and pushed through the tendon, then obliquely upwards and inwards through



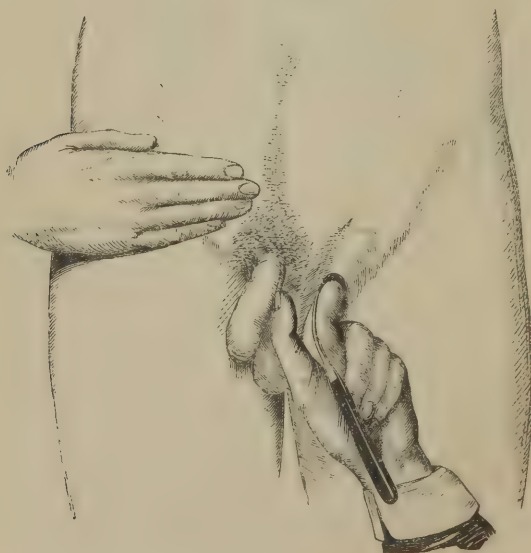
the internal pillar of the external ring, till the point is seen to raise the skin of the groin; and this manœuvre should be carefully preceded and covered by that of the finger. The skin is drawn in the same direction,

FIG. 407.



obliquely upwards and inwards, as far as its attachment will allow, and the point of the needle made to emerge (Fig. 408). One end of the wire

FIG. 408.



is then connected with the eye of the needle, and the instrument withdrawn by a quick jerk, carrying the wire in its course, after it, out through the scrotal aperture, the other end of the wire projecting through the puncture above. Directing the invaginating finger behind the external pillar of the ring to opposite the internal ring, as close as possible to Poupart's ligament, in the groove between the spermatic cord and the ligament; the needle carrying the ligature, is passed along the curve of the finger, and pushed through the aponeurosis of the external oblique at the above point (Fig. 409), when the skin is drawn upwards and outwards until the needle can be brought through the puncture before made. A loop of the ligature is then left in the puncture, and the needle withdrawn, carrying the free end. In the operation as more *recently* practised by Mr. Wood, the needle is *disengaged* from the wire, when withdrawn from the scrotal aperture—after making the puncture through the conjoined tendon; and, then it is passed *unarmed*, in making the second puncture, through the aponeurosis of the external oblique at Poupart's ligament. The opposite end of the wire there projecting, is then connected with the eye of the needle, and drawn through the puncture in the course of the needle, out through the scrotal aperture; and the instrument is again disengaged.

FIG. 409.



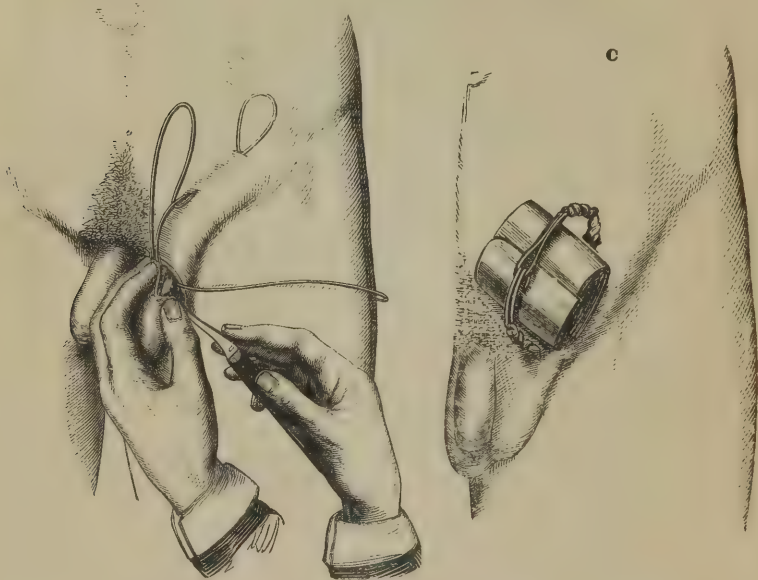
Thus, two ends of wire emerge together from the lower or scrotal aperture, after traversing the conjoined tendon and internal pillar on the inner side, and Poupart's ligament at the outer side; while the loop connecting them, emerges at the upper or groin aperture.

The sac of the hernia and investing fascia opposite the scrotal aperture, is then pinched up between the finger and thumb, and the spermatic cord slipped back, as in the operation for tying the veins in varicocele. The needle is then passed from without inwards and slightly upwards in the direction of the incision, across the scrotum, close to and in front of the spermatic cord; the needle entering and emerging entirely within the limit of the scrotal incision. If, however, the skin be accidentally punctured, the incision may be extended to meet that point. One of the ends of wire, the inner more conveniently for the purpose of compression, is then again hooked on to the needle, and drawn with it across the cord through or behind the sac, traversing the scrotal fascia (Fig. 410). Then, the ends of the wire are to be drawn down, until the loop above is close to the skin; here it is fixed by the finger of an assistant, while the Surgeon twists the ends round each other, giving them three or four turns. This manœuvre twists the enclosed sac and fascia which are held between the ends of the

wire. Lastly, the loop is drawn steadily upwards, so as to invaginate the twisted sac and scrotal fascia firmly into the inguinal canal, up to the internal abdominal orifice. The loop is then, in its turn, twisted well down into the upper or groin aperture, giving it the same number of turns. Certain manipulations will enable the operator to determine whether all is secure; by placing his fore-finger in the scrotal aperture, he may judge whether the external ring is closed satisfactorily by the tightening of the wire, and the effect of traction on the wire upon the posterior wall can also be distinguished. Great care should also be observed that the scrotal skin is not drawn upwards between the pillars of the ring, which would prevent their direct union. The projecting ends of wire are cut off by

FIG. 410.

FIG. 411.



pliers, about three inches from the surface, and hooked up under the loop; both forming an arch over the intervening skin. A roller is then lodged beneath the arch (Fig. 411, c), and a broad spica-bandage applied to make firm compression upon the roller, as steadied by the arch of wire.

The period for untwisting the wire is about the eighth or tenth day, and it may be removed about the fourteenth, or as late as twenty-one days when consolidation takes place slowly. A truss must be worn eventually, and Mr. Wood recommends the horse-shoe pad truss, of sufficient strength to support, but not to compress, with a pad formed to make flat pressure, and over the neighbouring parts as well as the obliterated canal. Cases have been treated entirely without truss.

The results of this operation give the encouraging proportion of 65 to 70 per cent. of successful cases; without reckoning doubtful and imperfect cases, and with a fair allowance for imperfect records and future casualties. This average percentage is also drawn from entirely unselected cases, as presented; oblique and direct, good and bad, many of them of



a very aggravated kind, some of enormous size, and treated by operative procedures some of which were more or less tentative.

*Irreducible hernia.*—Inguino-scrotal hernia, when irreducible, often attains a large size. It must be supported in a bag-truss, and thus also somewhat protected from injury.

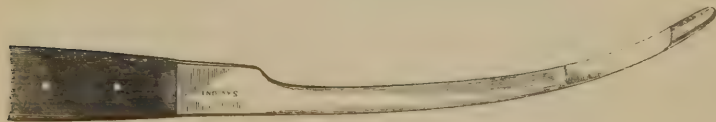
*Strangulated hernia.*—The operation for liberating inguinal hernia, at the seat of stricture, and thence returning the visceral protrusion, is conducted in accordance with the procedure already noticed in the general treatment of Hernia.

This operative procedure may be described as follows:—the patient lying on his back, and under the influence of chloroform, and the parts having been shaved; an incision is made in the course of the neck of the tumour (see Fig. 398), by pinching up the skin transversely about opposite the external abdominal ring and transfixing the fold. Any small bleeding arterial vessel had better be secured by a pinch or twist with the forceps, so as not to obscure the dissection. Then, cautiously dividing the superficial fascia and other coverings, by using the scalpel with a lateral, scraping action, or even more cautiously, by dividing the textures successively on a director; the sac is soon reached below the external ring, or above that point,—on thus dividing the tendinous aponeurosis of the external oblique. Rarely, the cord lies in front of the sac; if so, it must be drawn to one side, out of the way. The sac is recognised by its appearance; thin and translucent, and transmitting the colour of its hernial contents, in recent hernia; thick and opaque-white, in old hernia.

The seat of stricture is then sought for, as it may be found perhaps external to the sac;—either at the external abdominal ring, the border of the internal oblique muscle, or most frequently, at the internal abdominal ring,—in oblique hernia; or at the external ring, the margin of the conjoined tendon when ruptured, or most frequently, at the mouth of the sac,—in direct hernia. If situated at either of the more superficial points, with regard to either form of hernia, the stricture can be divided *external* to the sac; and then sometimes the hernia becomes reducible. Otherwise, the seat of stricture being *internal*, as it usually is, or if the symptoms of strangulation have been persistent; the sac must be opened, and in the ordinary manner. By carefully nipping up a small portion with the forceps and using the knife flatwise, a small button-hole incision is made; this aperture is then enlarged by slitting the sac upwards and downwards, cautiously, on a broad hernia director, and with a probe-pointed bistoury. If the director be elevated so as to stretch the sac over it, there will be scarcely any risk of wounding the bowel, which might otherwise overlap the instrument.

The seat of stricture is then again sought for by gently examining the

FIG. 412.



visceral contents of the sac. Situated commonly at the neck of the sac, the stricture must be divided with the *hernia-knife* (Fig. 412), protected

by the finger (Fig. 413). The direction in which it should be used has reference to the course of the epigastric artery. In oblique hernia, this vessel lies immediately internal to the mouth of the sac; in direct hernia, it courses externally. Consequently, the knife should be turned away in the opposite direction, respectively. But, owing to the dragging pressure, inwards, of an old-standing oblique hernia, it comes to simulate a direct hernia,—the artery however, still being *internal*. Hence, the safest direction for using the knife, and dividing the stricture in either form of

FIG. 413.



inguinal hernia, is neither outwards nor inwards, but directly *upwards*

FIG. 414.



(Fig. 414.) This should be observed as an absolute rule, and it is the injunction of Sir A. Cooper and Lawrence. The remainder of the operation, as to the reduction of intestine, omentum, or both, and the management of any adhesions, must be conducted according to the general rules already given.

This operation is more or less extensive, in proportion to the completeness or incompleteness of the hernia; as scrotal, or a bubonocoele. In rare cases, the absence of a sac may perplex the operator; as in inguinal hernia of the cæcum, sigmoid flexure of the colon, or urinary bladder. Reduction cannot perhaps be accomplished, when the stricture is divided, and the protrusion must be left *in situ*; but subsequently, it has sometimes disappeared spontaneously.

In the *female*, the operation is precisely the same; merely substituting the round ligament for the spermatic cord, in the inguinal canal; and the labium pudendi for the scrotum, in scrotal hernia.

*Congenital Hernia* requires a special adaptation of the foregoing treatment, and principally with reference to the situation of the testicle,—as

found in the scrotum, or above the external abdominal ring and perhaps in the abdomen. When, as usual, the testicle has descended into the scrotum, the hernia may be reduced, and a truss applied; which should be worn for a considerable period, not less than two years, in the hope of inducing adhesion of the neck in the inguinal canal—and thus a permanent radical cure. Children, who are naturally restless, and in whom the hernial parts are small, may generally be fitted more conveniently and precisely, with an air-pad truss. When the testicle has not descended, the hernia must be returned as often as it comes down; but no truss should be worn, lest it close the vaginal sheath of peritoneum and thus preclude the descent of the testis.

The radical cure of congenital hernia, by operation, has proved successful. This seems to be the *only* form of inguinal hernia in which Mr. Birkett considers an operation for radical cure to be applicable, and that all other kinds should be rejected as unsuitable. He alleges as the reason for this exclusive selection, the insufficiency of evidence to show that an acquired hernial sac ever becomes obliterated by any process of natural cure, excepting in very rare cases; and that the principle of the radical cure of hernia, by surgical interference, should be and is in fact, an imitation of some such natural mode of cure. It is unnecessary to raise this question further; suffice it to say that the results of the operation for radical cure, Mr. Wood's in particular, are such as to amply justify a more extended recourse to this practice in inguinal hernia,—whether congenital or ordinary hernia.

Strangulated congenital hernia will require an operation for its relief. The peculiarities are; that the stricture is perhaps always situated in the neck of the sac, which must be opened to divide it; the *sac* is the *tunica vaginalis*; it frequently contains a large quantity of serous fluid, clear or dark coloured, and the *testicle* at the bottom of the sac in contact with the visceral protrusion, which may be both intestine and omentum, adherent frequently to the testis. Lastly, division of the stricture may always be directed upwards and outwards with safety; the hernia necessarily being oblique, and lying therefore external to the epigastric artery.

In the *female*, the operation is precisely similar; the hernial descent taking place in the analogous vaginal process of peritoneum, known as the canal of Nuck, which ensheaths the round ligament of the uterus, as it passes down within the inguinal canal.

*Encysted hernia.*—The operation presents the peculiarity of a double sac; an anterior one, the tunica vaginalis, enveloping the true peritoneal hernial sac. The former, therefore, is first opened, exposing a serous cavity but no hernial contents; posteriorly, lies the hernial sac, invested externally by the glistening surface of the opened tunica vaginalis, the conjoined surfaces forming a double serous layer; the hernial tumour, with the testis attached below, is remarkably moveable and readily tumbles out, through the aperture in the tunica vaginalis, as a pyriform mass, suspended only by its attachment to the margin of the external abdominal ring. Proceeding with the operation, the double serous layer is divided, thus opening the hernial sac; which contains, as in other herniæ, intestine, omentum, or both. The stricture will usually be found at the neck of the sac, this is divided and the operation completed by reducing the protrusion.

FEMORAL OR CRURAL HERNIA.—*Course.*—This form of hernial pro-



trusion descends vertically below Poupart's ligament, through the crural ring and canal; lying in the sheath of the femoral vessels, internal to the femoral vein. Emerging from beneath the sharp upper margin of the saphenous opening in the fascia lata,—that portion known as the upper cornu, or the femoral ligament, of the falciform border or process of Burns; the hernia comes forward, anteriorly, through the opening; and then turns upon itself abruptly, upwards, towards Poupart's ligament,—thus overlaying the portion in the crural canal; so that the upper cornu of the falciform border and the crural sheath intervene between the superficial and deep portions of the hernial protrusion. This curved course of femoral hernia is very important in relation to the direction of pressure necessary for reduction; it being requisite that the protrusion should be made to retrace its course; downwards, backwards, and upwards.

*Anatomical coverings, and relations.*—The layers of different textures which femoral hernia receives, successively, in its course from the crural ring, externally, are as follow:—peritoneal pouch forming the sac, subserous cellular tissue or septum crurale over the opening of the crural ring, fascia transversalis forming the anterior portion of the femoral sheath,—which with the septum crurale constitutes the *fascia propria* of Sir A. Cooper; and over the saphenous opening, the cribriform fascia or deep layer of the superficial fascia, with the superficial layer of this fascia containing fat, and then the skin.

These anatomical coverings are interesting in relation to the development of femoral hernia; but as in other forms of Hernia, the coverings become so altered and amalgamated as to lose their importance surgically. To persons who are fond of enumerating hernial coverings, it may be observed that the investments of femoral hernia are essentially the same as those of inguinal hernia, less two; the intercolumnar fascia—and the cremasteric fascia, in oblique inguinal; the intercolumnar and the conjoined tendon, in direct inguinal hernia. While, therefore, either form of inguinal hernia has seven anatomical coverings, femoral hernia has only five; although these may be subdivided anatomically, as if to show their pathological and surgical insignificance.

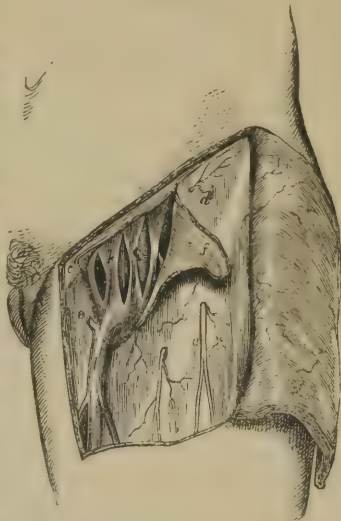
The relations of femoral hernia to surrounding parts are far more important. The *crural ring*, an aperture of oval shape, and about half an inch wide, is bounded; internally, by the base of Gimbernat's ligament and the margin of the conjoined tendon behind it; anteriorly, by Poupart's ligament with the curved band of the deep crural arch, the spermatic cord, or the round ligament in the female, lying above Poupart's ligament; externally, by the femoral vein with the innermost septum of the crural sheath; posteriorly, by the pubes, its horizontal ramus, covered by the fascia lata,—its pubic portion being prolonged over the pectineus muscle up to the pectineal line of that bone. The position of *vessels* around the crural ring is specially important with reference to the direction in which the stricture of femoral hernia at that aperture may be most safely divided. Commonly, the ring is partially surrounded by vessels; on the outer side, by the femoral vein and at the upper angle by the epigastric artery; anteriorly, the pubic branch of the epigastric runs to the back of the pubes, and more removed from the aperture lie the spermatic vessels of the cord. Thus then, the ring is encircled by vessels, excepting internally and posteriorly. An abnormal origin of the obturator artery may, however, give an additional vascular relation to the ring. Sometimes this artery arises from the (deep) epigastric, and in its course to the notch

in the obturator foramen, it may have either of two positions relative to the ring; passing down more frequently, on the outer side; or arching over and down on the inner side, at the base of Gimbernat's ligament, an occasional course which occurs once in about eighty operations. (Lawrence.) In the one position, the inner side of the ring is still free from any vessel; in the other, it is then completely encircled with vessels, except posteriorly in its relation to the pubes.

The small pubic branch from the epigastric, which runs to the back of the pubes, may perhaps pass downwards near the inner side of the ring to anastomose with the branch from the opposite side; or again, the epigastric artery, having its unusual origin from the obturator or from the femoral artery, may, it is said, ascend under and on the inner side of the ring.

The *crural canal* is the innermost space in the interior of the crural or femoral sheath; the femoral vein, and external to it, the femoral artery, being likewise contained in this sheath. (Fig. 415.) The latter is formed by a prolongation from the fascia transversalis of the abdomen, with a prolongation from the iliac fascia covering the iliacus muscle. Both fasciæ thus named, are only different parts of the same membrane, and are continuous along the line of Poupart's ligament external

FIG. 415.



to the iliac vessels; here, the one passing down in front, and the other behind the vessels, as they become femoral under Poupart's ligament, the two portions of fascia together form a loose funnel-shaped sheath, enclosing the vessels,—in addition to their common cellular investment. This sheath narrows as it continues downwards to about two inches below Poupart's ligament, where its distinctive appearance is lost in the common cellular investment. Its outer border is straight, and perforated by the genito-crural nerve; its inner border is oblique, and appears in the saphenous opening, transmitting the saphena vein and lymphatics. Two very thin septa divide the sheath into three compartments; one septum passes between the femoral vessels, each of which is thus placed in its compartment, while the other septum lies on the inner side of the vein, and defines the compartment known as the crural canal. Its extent is about half an inch in length, reaching only from the base of Gimbernat's ligament to the upper cornu of the saphenous opening. Anteriorly, the sheath forming the canal, is overlaid by the upper cornu of the falciform border of the saphenous opening; posteriorly, is the pectineus muscle covered by the fascia lata, its pubic portion. Externally, is the femoral vein and inner septum of the sheath, already noticed; internally, the sheath alone bounds the canal, owing to the oblique direction upwards of its anterior boundary,—the upper cornu of the falciform process inclining upwards, to join the base of Gimbernat's ligament.

The *saphenous opening*, for the transmission of the saphena vein and superficial lymphatic vessels, is formed by the division of the fascia lata into an iliac and a pubic portion. This opening has an important relation to femoral hernia, in the course of its development. Situated about half an inch below Poupart's ligament, and rather to the inner side of the middle line of the thigh, it is of an oval form, and extends from the superior cornu downwards to the inferior cornu, or about one inch and a half in length, and its width is about half an inch. The inner border is ill-defined, and lies on a plane posterior to the outer margin and the femoral vessels; the pubic portion of the fascia lata, forming this border, passes upwards underneath the sheath of the vessels, over the subjacent pectineus muscle to the pectineal line of the pubis. The outer margin,—falciform border or process of Burns, is anterior to the inner border, it is firmer and well defined, of a semilunar or falciform shape, and its concavity looks downwards and inwards. It is connected by fibrous bands to the sheath of the vessels. The *upper* portion of this firm margin corresponding to the crural canal, has a direct relation to the *development* of crural hernia; and the rigidity of the whole falciform border of the saphenous opening, especially in its bearing on the canal, is much affected by the position of the limb; extension and rotation outwards, having the effect of tightening the margin, while, flexion and rotation inwards, relaxes it. At the saphenous opening, the *inner* aspect of the sheath of the femoral vessels is uncovered; but the opening is closed in by the thin, deep layer of the superficial fascia, which is connected with the margin of the opening, and more firmly with its external or falciform border. This membrane is, however, weakened by the transmission of certain vessels; at the lower part of the opening, by transmitting the saphena vein, and by numerous small apertures in the fascia,—hence named cribriform, for the passage of the superficial lymphatics. Any resistance which the membrane might, otherwise, offer to a hernial protrusion, is lessened by this defective support. The subjacent portion of the femoral sheath is pierced by the same vessels, and weakened accordingly.

When the hernia has escaped through the saphenous opening, and turned up over the crural canal towards the abdomen; its *return* is much affected by the state of the saphenous opening, and of its upper portion in particular.

*Seat of Stricture.*—The strangulation of femoral hernia may be situated; either at the crural ring, and caused by the base of Gimbernat's ligament with perhaps the margin of the conjoined tendon, internally, and Poupart's ligament with the band of the deep crural arch, anteriorly; or, at the margin of the saphenous opening, and caused by the falciform border, its upper corner in particular as it arches over the hernia escaping from the crural canal. These are the situations of stricture pointed out, respectively, by Lawrence and Hey.

Thickened bands of fascia propria, situated about half an inch below the crural ring, across the neck of the sac, may also be an occasion of stricture; so as to constrict and indent the neck. This was noticed by Sir A. Cooper, and it is specially adverted to by Mr. Luke.

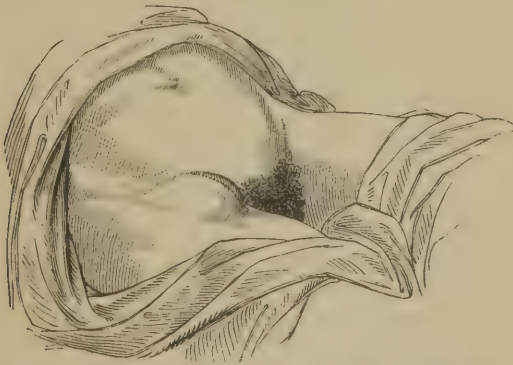
*Varieties* of femoral hernia, characterized by the course of the sac, may be here noticed, as being rare and curious. Le Gendre describes four such varieties:—(1) *Pectineal crural hernia*.—The hernia, as soon as it traverses the crural ring, passes directly internal to and *behind* the



femoral vessels, and rests on the pectineus muscle, the aponeurosis of which may form an envelope to it. This is sometimes denominated Cloquet's hernia, he having first described it. Callisen, Vidal (de Cassis), Richet, Le Gendre, and Mr. J. Adams, have recorded similar cases. (2) *Crural hernia, through Gimbernat's ligament*.—This variety is situated internal to the femoral vessels, but it passes directly through the resisting Gimbernat's ligament. It is the hernia of Langier, who first noticed it; and Cruveilhier, Demeaux, Nuhn, and Le Gendre, have also dissected cases of this kind. (3) *Crural hernia, with a diverticulum through the cribriform fascia*.—The hernia traverses several openings in the cribriform fascia, and thus forms several distinct lobes, which give it a very characteristic appearance. This is the hernia of Hesselbach, who first described and figured it; and Le Gendre and Malgaigne have also dissected examples. (4) *Crural hernia, with a diverticulum through the superficial fascia*.—A variety, in which the hernia, having escaped beneath Poupart's ligament and traversed the cribriform fascia, sends one or more prolongations through the superficial fascia. It is the hernia of Sir A. Cooper, and Le Gendre has furnished a dissection and drawing of such protrusion. (5) *Crural hernia, external to the femoral vessels*, is another variety, described by Mr. Partridge as having occurred in one case.

*Signs, and Diagnosis*.—The tumour of femoral hernia presents certain distinctive characters. It is situated below Poupart's ligament (Fig. 416)

FIG. 416.



by about half an inch or the length of the crural canal, and to the inner side of the femoral vessels, but external to the spinous process of the pubes. These relations have reference to the *neck* of the tumour, and femoral hernia may thus be distinguished from inguinal, whether this be a bubonocoele or scrotal hernia. The shape of the tumour is tolerably rounded, and it extends upwards to Poupart's ligament, assuming a transversely elongated form; rarely, it passes downwards upon the thigh. It may attain the size of an orange or larger, though it seldom increases to the size of inguinal hernia. In point of consistence, the hernial tumour will of course vary with the contents of the sac,—as to the presence of intestine, omentum, or both,—an entero-epiplocele, and the quantity of serous fluid in the sac will also affect its tension. But the size of the protrusion materially affects its tension; a small hernia, particularly a knuckle of intestine, deeply seated in the angle between the body of the

pubes and the femoral vessels, presents a tense unyielding lump; while a fully developed, hemispherical hernia has a soft, doughy, consistence. The reducibility of the tumour, and its varying size, according to posture, straining or coughing, and the impulse then communicated; are all additional signs of its hernial nature.

*Females* are much more subject to crural hernia, than males. Perhaps this greater liability may be owing to the larger size of the crural ring in the female. But, as compared with inguinal hernia, the much more common occurrence of femoral hernia, as generally supposed, is not verified by Kingdon's statistics, to which I have already referred. The relation of femoral hernia to *age*, in the female, is remarkable, and explains the numerical equality of the two forms of hernia. Before puberty, inguinal hernia is common, whilst crural is extremely rare. Of 193 girls affected with hernia, before fifteen years of age; 184 were cases of inguinal, and only 9 crural rupture. Even to the age of twenty years, the one is much more common than the other form of hernia; and in a total of 1442 hernial cases in females, at *all* ages from birth upwards, the majority of crural hernia over inguinal was only 54.

After twenty years of age, crural hernia is much more commonly developed than inguinal, and it occurs most frequently between the ages of twenty and forty—*i.e.*, during the prime of life in women. This peculiarity is due to that being the period of life when parturition is also most frequent, whereby the abdominal walls become much stretched and relaxed; and Mr. Kingdon's statistics show that this has a greater tendency to develop crural rather than inguinal hernia. In 680 ruptured women; 262 had the one, 178 had the other form of hernia. The first pregnancy also, has the most predisposing influence, as regards either form of hernia; subsequent pregnancies seem to have an almost invariably declining tendency.

*Diagnosis from other tumours, in the femoral region.*—*Psoas abscess* differs from femoral hernia, in its situation, the characters of the tumour, and its history. The abscess presents below Poupart's ligament, but to the *outer* side of the femoral vessels. It is partly at least reducible in the recumbent posture; and careful palpation with either hand alternately, above and below Poupart's ligament, demonstrates a corresponding subsidence and enlargement, in these situations, as of fluid passing to and fro. The antecedent symptoms of pain in some part of the dorsal or lumbar spine, and constitutional disturbance, will corroborate the diagnosis; any impulse on coughing notwithstanding. *Cysts* occasionally form in the neighbourhood of the crural ring, and associated with hernia, or existing alone. The fluctuation on pressure, with persistence of the swelling and its invariable size; will mainly determine the nature of the case. *Venous dilatation*, or a *varix*, may occur at the saphenous opening. Any such enlargement is reducible like hernia, but pressure above will cause the swelling to be reproduced. The characters of varix are also marked, as to the thrill and murmur, and the varicose enlargement of the vein below the crural tumour. *Enlarged crural lymphatic glands*, may be distinguished from hernia, by the aggregated character of the swelling, and its persistence, and by the absence of any impulse on coughing. The history of the case will also be corroborative. *Fatty tumour*, of small size, and situated in the crural canal, has occasionally been met with. It closely simulates hernia. The soft and doughy character of this growth contrasts with the tense consistence of crural hernia, similarly placed; and the absence of impulse on coughing is also distinctive.

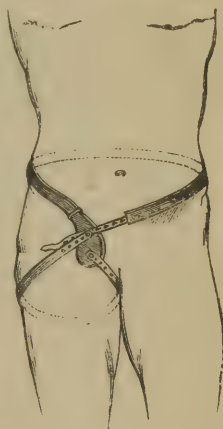
*Treatment.*—This must have reference to the state of the hernia; as reducible, irreducible, or strangulated.

*Reducible femoral hernia*, must be treated in the usual manner; the protrusion returned by taxis into the abdomen, under the influence of chloroform, and a suitable truss applied, and worn, over the crural aperture. The *direction* in which manipulative compression should be made is specially important. Remembering the course of femoral hernia; a fully developed protrusion should be returned by gentle pressure, downwards from Poupart's ligament, in order that it may turn the sharp upper corner of the falciform border of the saphenous opening, then directly backwards as if into the thigh, and upwards, through the crural canal. In short, the hernia is unfolded as it were, and made to retrace its course into the abdomen. During this manipulative proceeding, the Surgeon may avail himself of a relaxed state of the saphenous opening, by flexing and rotating the thigh inwards.

FIG. 417.

The size of the truss-pad should vary with the degree of laxity of the part, and chiefly as regards Poupart's ligament. A small, convex pad will generally prove sufficient support; but a lax state of the ligament will require a larger and flatter pad.

*Femoral Trusses.*—Three principal forms of femoral truss have been devised, which are thus described by Mr. Bigg. All possess the ordinary steel spring pelvic belt. (1) The spring is curved downwards, so as to rest above the femoral region, and is fitted there with a pad, so shaped (Fig. 417) as to exercise pressure just below Poupart's ligament when the patient flexes the thigh upon the body, as in walking or sitting. (2) Another form of femoral truss is furnished with an inflated india-rubber pad. This is admirably suited for old-standing cases; and proves effective, even when the patient is racked with cough or undergoes severe muscular exertion. (3) The pad is self-adjusting, attached to the spring by a steel blade. This variety is useful for horse exercise. When the hernia is of large size, or where it comes down under the fascia lata, it is necessary to use a thigh-belt with a triangular pad projecting on the inner surface; forming a soft continuation of the pad, to fill the triangular space where the cribriform fascia occupies the saphenous opening of the fascia lata.



The hernia rarely, if ever, undergoes a radical cure, in consequence of wearing a truss; thus differing unfavourably from inguinal hernia in respect to this issue, occasionally.

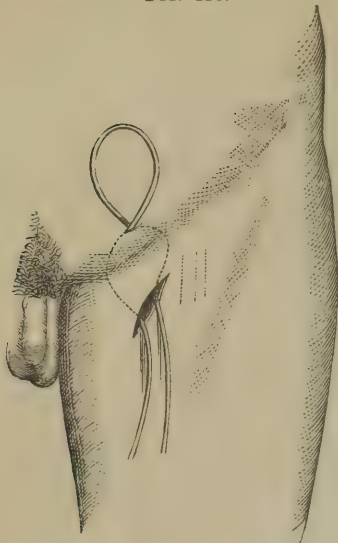
*Radical cure.*—Little has hitherto been done to effect a radical cure of femoral hernia. The operation of invagination into the hernial aperture, was performed in one case, by Dr. G. Jameson of Baltimore, North America; and in another case, with a hard plug retained by sutures, as performed by Mr. Redfern Davies. Both patients survived, but the results with regard to the recurrence of hernia seem to have been very doubtful.

An operation proposed by Mr. J. Wood, but practised only at present, on the dead subject, is performed in the following manner; the instruments used being the same as for inguinal hernia, by the wire operation.



The body lying recumbent with the shoulders raised, a vertical incision about an inch long is made through the skin over the site of crural hernia. (Fig. 418.)

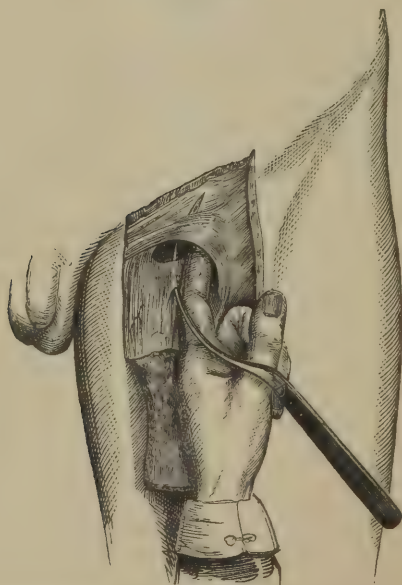
FIG. 418.



The fascia around the margin of the wound is detached subcutaneously to a sufficient extent for invagination, free from skin, fairly into the crural opening. Then, pressing the femoral vein outwards with the forefinger which is used for invaginating, the needle is passed backwards—through the sac were it present—sufficiently deep to take up the pubic portion of the fascia lata covering the pectineus muscle; the point of the needle being afterwards made to emerge in the wound. It is then carried forwards and upwards, and made to transfix Poupart's ligament close to the nail of the invaginating finger. (Fig. 419.) The skin of the groin is drawn outwards, by an assistant, and the point of the needle pushed through it. The wire is then hooked on to the eye of the instrument, and drawn back with it into the wound. Disengaging the needle, leaving the wire protruding, it is passed again through the pubic

portion of the fascia lata, about an inch or three-quarters of an inch—

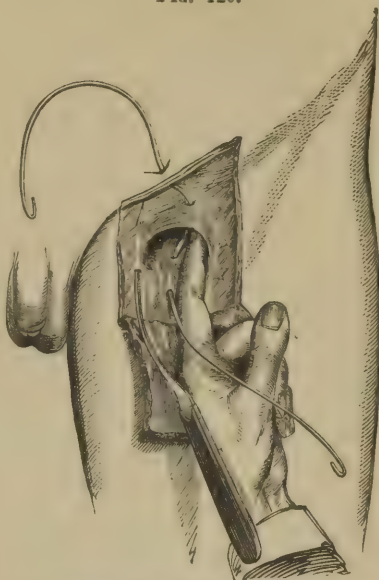
FIG. 419.



according to the size of the hernial aperture—to the inner side of the

first perforation (Fig. 420); and the point made to pass through Poupart's ligament directly above, and close to the curved border of Gimbernat's ligament, including a portion of its fibres. Drawing the skin inwards until the needle can be pushed through the same puncture before made, and which is already occupied by one end of the wire; the opposite end is hooked on to the needle and drawn back with it, when that end also is disengaged. The two ends of the wire are now twisted down into the incision, and cut off about six inches from the twist. The loop which emerges at the upper puncture is then twisted firmly down in it, pressing down before it that portion of Poupart's ligament opposite the crural opening, which is included in its grasp. A roller of lint, or a boxwood or glass compress of cylindrical form, is applied and secured in position by the ends of wire drawn over it, with pledgets of lint on each side; and over all, a spical bandage.

FIG. 420.






By this operation, that part of the tendinous crural arch which overrides the neck of the sac, is drawn backwards and downwards, so that it may become adherent to the pubic portion of the fascia lata included in the suture. In a large hernia, the sac and its coverings would be transfixed, and embraced in the suture; in a small hernia, the serous sac might easily be returned into the abdomen, and its tendinous investments united altogether external to it. The result might be, that the invaginated fascial and sac-coverings would become adherent on all sides, under the combined influence of ulceration, traction, and pressure; and thus forming a consolidated mass, filling up the area of the crural ring, a radical cure might be accomplished. Its permanency would require the test of time.

Certain parts, contiguous to the operation, should be carefully avoided; the femoral vein,—by interposing the finger between it and the needle during the passage of that instrument; the bowel, the epigastric artery, and in the male, the spermatic cord,—by not pushing the needle too far into the abdominal cavity.

*Irreducible hernia.*—Crural epiplocele very often becomes irreducible, but enterocele in this state is equally rare. No other treatment can be pursued than to support and protect the hernial tumour by a truss with a hollow pad; and this, whether it be epiplocele or enterocele.

*Strangulated hernia.*—Both Pott and Astley Cooper allude to circumstances which are of vital importance in the treatment of crural hernia;

namely, the difficulty often experienced in the reduction of small recently developed enterocele, the rapidly progressive injury to the bowel, and the severity of the accompanying constitutional symptoms. Thus also Mr. Bryant found only 38 cases reducible by taxis, out of 142 cases of strangulated crural hernia admitted into Guy's Hospital. Ten of these cases were herniæ of recent development, and strangulated on their *first* recognised descent. Hence, the Surgeon should always search for a hernial tumour, however unsuspected by the patient. Reduction having failed, and symptoms of strangulation being persistent; an operation for the division of the stricture and liberation of the hernial protrusion, must be had recourse to, as soon as possible. This rule of early operation is no less imperative in femoral than in inguinal hernia.

*Operation.*—The general principles already laid down with reference to operation for the relief of strangulated hernia, are here applicable. In regard to femoral hernia, the stricture may be divided *external* to the sac, and the protrusion returned without opening the sac, and this limited procedure is generally practicable; when *internal*, it will become necessary to open the sac, in order to divide the stricture from within. The patient lying recumbent, chloroform having been administered, the parts shaved, and the bladder emptied; an incision is made by pinching up and transfixing a fold of skin, transversely across the tumour on its pubic aspect, and inclining inwards, so as to reach the seat of stricture. (See Fig. 416.) This latter direction is the special feature of Mr. Gray's admirable modification of the operation—that the incision be placed on the inner side of the neck of the tumour. If the sac be not opened, the operative procedure is thus simply the taxis, plus a slight incision. Other forms of incision are occasionally convenient; a transverse line may be added obliquely, along Poupart's ligament, as thus ; or the inverted  of Sir A. Cooper, or the inverted  of Sir W. Fergusson. The superficial fascia is then divided, and any little hæmorrhage restrained which might obscure the dissection, by pinching or twisting any bleeding arterial vessel. A round tumour is now exposed, having a peduncle curving upwards into the abdomen, at the angle between the body of the pubes and the junction of Poupart's ligament with the spinous process. This is the hernia, but invested with the fascia propria—the femoral sheath of fascia transversalis united with the sub-peritoneal cellular tissue, which may be loaded with fat, and occasionally studded with small cysts. Accordingly, the fascia propria may be thin and membranous; or thickened, and present an almost omental appearance, especially in old-standing hernia long subject to the pressure of a truss. In the one case, the sac lies immediately underneath the fascia; in the other, the sac is buried within its substance. Passing the finger up on the neck of the tumour, the sharp upper margin of the saphenous opening in the fascia lata, may be felt constricting the neck; and immediately behind this, the junction of Poupart's ligament with the base of Gimbernat's ligament may also be the seat of stricture. These strictures should be divided successively; first the falciform border at its upper corner, in order to find the necessity for proceeding a little more deeply to Gimbernat's ligament. Introducing a hernia-knife along the curve of the finger, and insinuating its point between these ligamentous constricting bands and the neck of the tumour, just to within the crural ring; this double stricture can be overcome by dividing it *upwards* and *inwards*—on thus obliquely directing the cutting portion of the knife. It yields with the usual creaking sound and sensation; and a very limited



extent of incision will prove sufficient. Having divided one or both strictures, the hernia may not unfrequently be reduced, without opening the sac, by gently compressing its contents. Sometimes, however, another source of stricture may still exist, in the form of thickened bands of fascia propria, situated about half an inch below the crural ring, across the neck of the sac, constricting and indenting it. These may be divided, as Luke recommends, by insinuating the nail of the finger under them from above, and carrying the point of a probed bistoury along the nail, with its blunt edge towards the sac.

But, if this fails to liberate the hernia, or if the symptoms of strangulation have become thoroughly established, even to stercoraceous vomiting, and the visceral protrusion may have suffered also by prolonged taxis; it will then be necessary to proceed to lay *open the sac*. The fascia propria must first be divided carefully on a director. When thin and membranous, the sac is at once exposed; when thick and fatty, and perhaps cystic, this must be done cautiously, by making more than one layer with the knife and director, lest the sac be inadvertently opened and its visceral contents be wounded. On the other hand, it must be observed not to *make* a sac of one of the artificial layers of the fascia propria, and then, mistaking the true sac for intestine, not to open the hernial sac at all. This latter sac having been fairly exposed, it is opened in the usual manner; a small button-hole incision being made by means of the forceps and knife used flatwise, and the aperture enlarged on the broad director, upwards and downwards; the seat of stricture is then sought for, commonly at the thickened peritoneal mouth of the sac, and this must be divided upwards and inwards, as being the direction of least risk to any vessel adjacent to the crural ring. Sometimes, the ligamentous or fibrous structures external to the neck of the sac having been divided; the mouth of the sac can be sufficiently dilated by gently introducing the point of the finger, without any further use of the hernia-knife. The contents of the sac and any adhesions are then dealt with according to the general rules already given. An entero-epiplocele is usually found; and the omentum lies mostly in front, enclosing and concealing a knuckle of intestine.

Hæmorrhage, perhaps considerable and persistent, is liable to occur in dividing the stricture at the crural ring. This accident is peculiar to femoral hernia, and it has led to a fatal result occasionally, in addition to the ordinary hernial contingency of peritonitis. I have lost one case, owing to the continuance of hæmorrhage internally; and Guthrie states that some of the best Surgeons have lost patients by hæmorrhage after the operation for femoral hernia. It proceeds from the obturator artery, that vessel having its unusual origin from the epigastric artery, and the more unusual course of then arching over the ring and descending on the inner side at the base of Gimbernat's ligament. This vessel will thus be across the knife in dividing the stricture upwards and inwards. Sometimes, it is said, the small pubic branch from the epigastric, running to the back of the pubes, passes downwards near the inner side of the ring to anastomose with the branch from the opposite side; or again, the epigastric artery having its unusual origin from the obturator or from the femoral artery, may ascend on the inner side of the ring. The same liability to hæmorrhage would then occur, in dividing the stricture at the crural ring. Any such unusual source of hæmorrhage, it will be difficult to anticipate or control. Before introducing the hernia-knife, it might be practicable to feel the pulsation of the aberrant artery with the

tip of the finger; or, as Erichsen recommends, the precaution might always be taken of blunting the edge of the hernia-knife, so that the tense fibrous constriction may yield, while the artery is pushed before the blunted edge. When cut, the vessel may perhaps be drawn to the aperture and tied, or twisted at both ends; or the hæmorrhage may be arrested by plugging with lint or sponge, and by cold applications. Secondary hæmorrhage will necessitate a fair exposure of the vessel, by cutting down in the course of the hæmorrhage, and tying whatever vessel bleeds. Occasionally, an artery bleeds which at the time of operation did not; it will then scarcely be justifiable to cut down and explore for an unknown source of hæmorrhage, and the only expedient is a cold application.

A too free division of the stricture at the crural ring, unattended with hæmorrhage, may be followed by an increased liability to hernial protrusion, after recovery from the operation. This result is owing to a weakened state of Poupart's and Gimbernat's ligaments at their angle of junction. The truss, worn after operation, will then require the additional support of a cross tongue, buckled on to its free end.

UMBILICAL HERNIA.—*Exomphalos* or *Omphalocele*, as umbilical-hernia is also sometimes called, signifies a visceral protrusion through the umbilical aperture; in common language, ruptured navel. The *course* of the protrusion, in this kind of hernia, is straight through the abdominal wall.

The hernial sac is always an acquired extension of the peritoneum, there being no process analogous to the inguinal vaginal process of this membrane. Yet umbilical hernia is sometimes described as of two varieties; the *congenital*, with reference to its formation in infants from birth; and the acquired variety, which is developed in *adults*. In the one condition of hernia, the protrusion passes through the umbilical aperture, either before the cord is detached, or before that aperture has closed; in the condition of later or adult life, an aperture is formed by a separation of the fibres of the linea alba at the formerly closed umbilical ring or an immediately adjoining part, in consequence of its having stretched or yielded before the protrusion from within.

The anatomical *coverings* of umbilical hernia are those of the abdominal wall, at the umbilical aperture. Taken from within outwards, in the order of hernial development, they are successively; a pouch of parietal peritoneum or the hernial sac, with sub-peritoneal cellular tissue containing fat, and the fascia transversalis, then a prolongation from the tendinous margin of the aperture, the superficial fascia, and skin. Before the separation of the umbilical cord, the protrusion may pass through the navel-opening, directly into the substance of the cord, which thus forms a peculiar covering to the hernia. In a suddenly produced umbilical hernia, the covering derived from the tendon of the external oblique muscle may be wanting; and the fat, subcutaneous, in the superficial fascia, or that over the peritoneal investment may have disappeared. All the coverings are often inseparably united together, so that the common covering is frequently very thin, and the contents of the sac become more or less perceptible. The umbilical aperture forms a very firm and unyielding tendinous margin around the neck of the sac, itself somewhat thicker at this part than over its expanded part or body. The mouth of the sac is often large in proportion to the bulk of the protrusion. As the hernia increases in size, the varying anatomical relation of the umbilical aperture

becomes important. The tumour does not extend uniformly upon the anterior surface of the abdomen, but downwards towards the symphysis pubis more than in any other direction. Occasionally, the transverse diameter of the tumour exceeds the vertical, or it may be pyriform and suspended by a peduncle or stalk. Sometimes, it is sessile, with a base almost as large as its body; or it may be only apparently so, and when elevated presents a small stalk, thus resembling a mushroom in shape. The visceral contents of umbilical hernia are, commonly, both intestine and omentum—an entero-epiplocele; and in a large hernia, nearly the whole intestinal canal, small and large intestine, may be found enveloped by omentum. The latter sometimes becomes firmly adherent to the sac, or bands are produced by which the intestine becomes entangled; while by hardening and contraction of the omentum, this portion of the protrusion forms anomalous masses within the sac. Other viscera, occasionally, are included, as the stomach, or uterus; in one case, Murray found that the gravid uterus, at the eighth month of pregnancy, formed the contents of an umbilical hernia.

The *stricture* in this kind of hernia, is the firm margin of the umbilical ring.

Certain *signs* in connexion with the tumour are characteristic. The hernia commences as a small soft, projecting ovoid tumour, at the navel. (Fig. 421.) It gives a distinct impulse on coughing, but is readily re-

FIG. 421.



ducible by gentle pressure with the finger; and a small aperture is then felt, having a firm sharp border. On removing the finger, the skin remains relaxed and creased in the fossa of the navel; or it unfolds and distends, until the tumour reappears as before. As the hernial protrusion increases, the tumour assumes other forms, according to the anatomical relations of the umbilical aperture, in point of its size and position with regard to the protrusion. Hence a pendulous tumour is presented, semi-lunar transversely, or pyriform, with the aperture towards its upper part; or a round, flattened, and sessile, or nearly stalkless tumour.



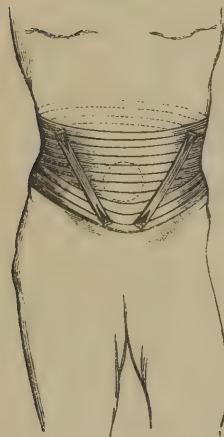
Umbilical hernia often attains a large size, and an irregular shape as if consisting of several tumours, owing probably to the yielding of its fascial or tendinous coverings at different parts; it has also a partly doughy and tympanitic consistence, according to the visceral nature of its contents. When adhesions to the sac have taken place, the tumour is proportionately irreducible.

This kind of hernia occurs mostly in infancy, at birth before the cord is detached, or before the umbilical aperture has closed; or in adult life, and indeed at any period of life; and in both sexes. Females are most liable, and especially those who have borne many children, or have a tendency to abdominal obesity.

The immediate cause, as in other herniæ, is some straining effort of the abdominal muscles; as by the act of crying in children, coughing or parturition in adults and females.

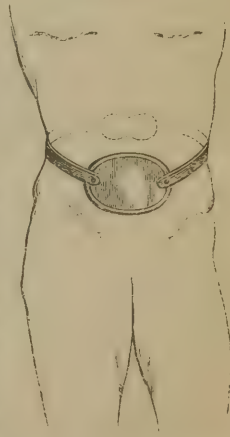
*Treatment.*—*Reducible umbilical hernia* should be returned, and a proper support worn over the hernial aperture. In infancy, an elastic india-rubber belt with an air-pad, is most effectual; or a simpler and more ready contrivance, is a slice of cork covered with leather, so as to form a firm, flat, compress over, not in, the aperture; and retained by cross strips of plaster and a broad circular bandage. Thus supported, the aperture has a strong natural tendency to close. In adults, a suitable truss must be worn, made on the same principle as for the hernia in infancy. The annexed figures represent the most appropriate forms of Truss; a broad elastic bandage, of such width as to support the whole weight of the abdominal viscera, and carrying a pad which rests upon the umbilical aperture and localizes the force there. (Fig. 422.) Another

FIG. 422.



form, suited for severe cases, is a lightly constructed steel-truss. (Fig. 423.) The *radical cure* by operation has been performed by Mr. Wood, in three obstinate cases. He applied a small pair of rectangular pins vertically, and in opposite directions, one on each side of the opening, transfixing the edge of the tendinous aperture, and making them emerge close to each other through the integuments above and below the opening. When locked into each other, and twisted, the edges of the aperture

FIG. 423.



were drawn close together in a line with the linea alba, so as to protrude the integuments and sac of the rupture in a vertical fold above them. The pins were surrounded, and the skin protected, by strips of lint and plaster, and were retained four days, without any unpleasant symptoms. They were then withdrawn, and the edges of the aperture had firmly united. A pad and circular bandage were used for a short time, and the child was then discharged from the Hospital. While under observation, no return

of the rupture had occurred. An *invaginating* operation has also been performed by the same Surgeon, on the principle already fully explained with regard to inguinal and femoral herniæ. The details of this procedure are given in Mr. Wood's Treatise. Respecting its applicability, it is said that, in favourable cases of umbilical hernia in the adult, this operation may be tried with but little danger, considerable probability of success, and the certainty of not rendering the state of things worse by interference. Other Surgeons have successfully effected a radical cure by operation; Mr. Barwell on three patients at the respective ages of six months, fifteen months, and eight years; Mr. H. Lee has also cured cases on the plan of the operation already described; and Mr. C. Heath, in a case of strangulated umbilical entero-epiplocele, having returned the bowel, he dissected the sac away and passing a ligature through its base and the omentum, these were then removed. Recovery ensued, and some time after no hernial protrusion had recurred. But considering the strong tendency to a natural cure, in *infancy*, when the abdominal aperture is properly supported and for a sufficient period; it will always be a serious question whether any cutting operation is justifiable?

*Irreducible* umbilical hernia must be treated on the usual principle of support and protection by means of a bag-truss.

*Strangulation* rarely arises. The symptoms of obstruction and nausea or vomiting, may be those of incarceration, and are mostly dependent on a flatulent and loaded state of the intestinal canal; and this can generally be overcome by purgatives and enemata, with re-employment of the taxis a second and a third time, at intervals of two or three hours. On the other hand, the symptoms of true strangulation are very insidious in umbilical hernia, especially when the tumour is old-standing and irreducible. Consequently, timely recourse to operation must not be overlooked.

The operation is very simple. An incision in the middle line over the neck of the tumour, and to about two inches in extent, will generally suffice to reach the constriction at the umbilical aperture. The fascial coverings should then be carefully divided as the sac is soon reached; the finger-nail is inserted under the firm margin of the aperture, and the stricture slightly divided upwards, without opening the sac, and the hernia returned into the abdomen; or, if reduction cannot thus be effected, the sac must be opened, and the constriction divided within, upwards in the same line as the first incision. The omentum and bowel are then managed on general principles. Any other situation around the neck of the tumour may be selected for operation, when more convenient with regard to the position of the neck; and the stricture may be safely divided at any such point in the circumference of the umbilical aperture, there being no vessel fairly within the way of the knife in any direction. This operation has been performed during pregnancy, a complication not much affecting the case, and instances of successful results are recorded by Sir A. Cooper and Lawrence.

After the operation, under any circumstances, a large flat pad-compress must be applied over the hernial aperture, and retained in position by a broad flannel roller.

VENTRAL HERNIA signifies a protrusion through any other part of the abdominal wall, except the apertures already noticed. Commonly, this hernia occurs at the *linea alba*, the *lineæ transversæ*, or more externally, at the *lineæ semilunares*. The anatomy of ventral hernia may be inferred from the particular part of the abdominal wall where it happens to occur;

any such protrusion is usually the result of some lacerative or rupturing injury, the characters of the tumour are similar to those of umbilical hernia, and the treatment is the same.

**LUMBAR HERNIA** may be described as a variety of the preceding; but the tumour projects in the loins, between the crest of the ilium and the last rib. It arises usually from contusion or laceration of the lumbar muscles. Dr. Chapplain relates the case of a man, who after a violent squeeze between a wall and a carriage, found a tumour in his loin; and Mr. Kingdon saw a case where the bowel protruded just above the crest of the ilium at its highest point, about three inches from the spine, in the linear interval between the quadratus lumborum and abdominal muscles.

**OBTURATOR OR THYROID HERNIA.**—A very rare form of hernia in which the protrusion takes place through the obturator foramen. It was first noticed by Garengot in the early part of the last century, and has since been described by Vinson, Stanley, Hilton, Tebay, Oubr , and Bransby Cooper; and Birkett has collected twenty-five cases. The protrusion having escaped from the pelvis through the obturator canal, it is developed underneath the pectineus muscle, and in the pubic region of the thigh. The neck of the sac lies behind the horizontal ramus of the pubes, and occupies the obturator canal; the sac may then be confined between the obturator membrane and obturator externus muscle; or the protrusion makes its way, sometimes between the uppermost fibres of the obturator muscle, sometimes above them, and then the fundus and body of the sac is covered by the fascia of that muscle. The obturator vessels and nerve have a variable relation to the tumour; the artery has been found to the outer side, or to the inner side, and less frequently, behind the sac. In Stanley's case, both artery and nerve were above the sac; the former to its inner side, the latter towards its outer. The contents of the sac, are usually both intestine and omentum,—an entero-epiplocele; but only a portion of the calibre of the ileum may have descended, and be prolonged into a diverticulum of considerable length. In one case, the Fallopian tube and ovary formed the contents of the sac; in another, a portion of the urinary bladder.

*Symptoms.*—A small hernial tumour may be presented, which is more or less palpable and visible, situated below Poupart's ligament, in Scarpa's triangle and towards the pubes. There may be a slight fulness only to the eye, in the part of the thigh which is naturally hollow; but on deep pressure with the fingers, a hard lump is felt. In the female, examination per vaginam, should be made. No tumour, however, can be detected in a large majority of cases; and the existence of hernia has not been discovered during life. Strangulation has been known to supervene, without any local signs of a tumour. Acute pain in the course of the obturator nerve is the most marked symptom in all cases; pain occurring suddenly with the formation of the hernia, and proceeding from the upper and inner part of the thigh; thence extending down the inside of the limb to the knee, front of the leg, foot, and great-toe. Pressure over the site of the external aperture of the obturator canal gives rise to paroxysms of pain of great severity.

Both sexes are liable to the formation of this hernia, and females especially.

*Diagnosis.*—From *crural* hernia, a protrusion through the obturator canal may be distinguished by observing the relative positions of the



horizontal ramus of the pubes and femoral vessels. These parts, with the pectineus muscle, intervene between these two forms of hernia; in the one, they are behind the hernia and cannot be easily felt, not perhaps until it is reduced; in the other, they are in front of the tumour, which is therefore deep-seated, while the ramus and the pulsation of the artery can be felt superficially. With symptoms of strangulation and no tumour; there will still be the acute pain proceeding from the site of the obturator canal, and extending downwards along the inner side of the limb. But, exploration of the obturator region by means of an incision, will alone clear up the difficulty; and this procedure is justifiable with a view to relieving the symptoms of strangulation by operation.

Complications may be occasioned by the co-existence of one or more herniæ, especially in the inguino-femoral region. Thus, in one case, there was reducible crural hernia on either side; in three cases, a crural hernia on the same side as the obturator; in one case, on the opposite side; and in another case, an inguinal hernia on the same side as the obturator. Two obturator herniæ, one on either side, have been known to co-exist, in some cases.

The *treatment* is necessarily tentative, owing to the obscurity of diagnosis. If a hernial tumour be detected, it may be reduced by pressure so directed as to free the protrusion from the ramus of the pubes, and pass it underneath it. Otherwise, in the event of symptoms of strangulation, with, or without a hernial tumour; an exploratory operation must be resorted to. The incision should be either parallel with the trunk of the femoral artery, or with the border of the adductor longus muscle. Avoiding the femoral vein, the fascia covering the pectineus muscle and this muscle must be cautiously divided, some fat and the fascia of the obturator muscle are then reached. The tumour lies under this fascia, or possibly under the muscle, between it and the obturator membrane. The neck can be felt at the obturator canal, and the obturator nerve must be avoided.

PERINEAL HERNIA descends between the prostate gland and rectum; or between the vagina and rectum in the female,—the sex most liable. The peritoneal sac escapes between the anterior fibres of the levator ani, and is covered by the pelvic fascia. It usually contains intestine or omentum; occasionally, a portion of the urinary bladder. A tumour is presented in the perineum. Recurrence of this protrusion may be prevented by wearing a T-shaped bandage.

VAGINAL HERNIA is a variety of the preceding. The protrusion is covered only by peritoneum and the wall of the vagina; and presents a swelling in the vagina, instead of the perineum. It is easily reduced, as the orifice of the sac is usually large, and it must be retained by a sponge pessary supported by a T bandage.

PUDENDAL HERNIA descends between the ascending ramus of the ischium and the vagina. It forms a small elastic tumour in the labium pudendi, lying in the posterior and inferior half of this part, and presenting a somewhat elongated projection at the side of the vagina.

The *diagnosis* from other tumours is important. Other labial tumours which may be confounded with pudendal hernia, comprise those formed by inguinal protrusions and by collections of fluid. Of the latter, are cystic formations and hydrocele of the round ligament. These, however, are never reducible, nor diminished by pressure, and they slowly enlarge from their first appearance. From inguinal hernia, the pudendal is dis-

tinguished by its position, shape, and relations. Thus pudendal hernia has not passed through the external inguinal ring, but lies parallel with the axis of the vagina; it does not form a pyriform tumour in the labium, but a somewhat rounded mass; and it lies by the side of the ramus of the ischium, and not over the body of the pubes. From crural hernia the diagnosis consists, in the neck of the pudendal tumour being situated entirely to the inside of the ramus of the ischium and the attached muscles.

A suitable bandage is required to support the protrusion.

ISCHIATIC HERNIA escapes through the sciatic notch, above or below the pyriform muscle; usually below, between it and the spine of the ischium. Lying in close relation with the sciatic nerve and the internal iliac vessels, the tumour forms beneath the glutæus maximus muscle; but extending further out of the pelvis, it escapes below the border of that muscle and becomes sub-integumental. The hernial tumour is of variable size, soft or tense, causing more or less pain, and reducible on pressure. When not fully developed and of small size, lying also under the cushion of the glutæus muscle, the tumour will probably not be discovered during life.

When detected it may be reduced, and retained by means of a proper pad-support and bandage.

Strangulation will necessitate recourse to operation, always a difficult proceeding in regard to the anatomical relations of the hernia; and in enlarging the mouth of the sac, Sir A. Cooper recommends that the incision be made directly forwards.

DIAPHRAGMATIC HERNIA.—In this rare form of hernia, one or more of the abdominal viscera protrude upwards through an aperture in the diaphragm into the thoracic cavity. The hernial aperture may be one of the natural openings in the diaphragm; or an opening as the result of congenital defect; but usually it is an acquired aperture; caused by laceration in consequence of a violent compression or fall, or produced by a penetrating wound, as by gunshot injury. The viscera protruded are commonly the stomach or the transverse colon, with a portion of omentum. There is no peritoneal sac, and the hernia occurs only on the left side, the liver on the right side apparently preventing its formation there.

*Symptoms* arise as in other herniæ, constipation, vomiting, and pain; but dyspnœa is more or less urgent, and perhaps a hacking cough and bloody expectoration. The *diagnosis* from intussusception and internal abdominal strangulation will be scarcely possible, unless the thoracic symptoms be taken in connexion with the abdominal. Interesting cases are recorded by Dr. Reid in the Edinburgh Med. and Surg. Journal, 1840; by Dr. Copeman of Norwich in the Provincial Med. Journal of 1855, and by Mr. Erichsen in his work on Surgery.

*Treatment* will be of little avail, the hernial protrusion naturally increasing and attaining a considerable size. Mr. Guthrie, with his characteristic boldness in Surgery, proposed that an incision might be made through the abdominal wall, large enough to admit the hand to draw back the stomach into its proper place. Overlooking the doubtful question of diagnosis, it would be difficult to prevent the liability of a protrusion through the abdominal aperture after such an operation, in itself also otherwise dangerous; and it is more difficult to understand how the replaced organ could be made to remain in its place, unless indeed the opening or rent in the diaphragm were stitched up!

## CHAPTER LIV.

## INTESTINAL OBSTRUCTION.

No subject in Medicine and Surgery has a more comprehensive pathology, and the treatment of which is more frequently unsuccessful, than intestinal obstruction. Its pathology embraces numerous and diverse structural conditions of, or affecting, the intestinal canal, and in various portions of its extent; the symptoms of which in common, may be simple and obvious, but their differential diagnosis is obscure; while their course and terminations are perilous or uncertain; and the treatment having reference to such conditions, is proportionately ineffectual or impracticable.

The whole of this important but difficult subject has been ably considered by Mr. Pollock, who thus classifies these intestinal conditions. Excluding external abdominal herniæ of all kinds, the conditions, or causes, of intestinal obstruction may be divided into two classes; the acute, which generally produce most acute symptoms, early and sudden in their attack, and rapidly fatal in their results; the chronic, in which the symptoms are not at first urgent, and are more slowly developed, and recovery sometimes occurs without any assistance from treatment and often where there seems no hope of recovery.

*Acute conditions of intestinal obstruction comprise :—*

- (1) Congenital Strictures or Malformations.
- (2) Foreign bodies impacted in the intestines, and introduced through the stomach, formed in the bowel, or escaping by ulceration from the gall-bladder.
- (3) Twisting or “dislocation” of the bowel, most frequently found in the large, but often in the small intestine.
- (4) Loops, formed by bands of false membrane, adherent at both extremities; by diverticula, adherent by their apices to some portion of the viscera or abdominal wall; or by the fimbriated processes, or other portions of viscera, contracting adhesions, so as to form rings or apertures, entangling the intestine; all these usually the result of peritoneal inflammation.

(5) Mesenteric pouches; foramen of Winslow; or “thickened peritoneal sheaths,” the result of old herniæ.

(6) Invagination, often caused by worms, intestinal polypi, &c.

*Chronic conditions :—*

- (1) Constipation, habitual or accidental.
- (2) Inflamed, thickened intestine, the result of injury.
- (3) Chronic peritonitis,—tubercular and abscess.
- (4) Tumours pressing on the bowel,—hydatids, &c.
- (5) Simple stricture of intestine, the result of ulceration and other causes.

(6) Cancer of the bowel, producing contraction of the gut.

The relative frequency of different causes of obstruction irrespective of age, is shown in the following tabulated arrangement of 135 cases, collected by Mr. Hinton :—



Diseased uterus . . . . .	1	In first column . . . . .	26
Stricture of ileum . . . . .	1	Doubtful . . . . .	8
Cancer of small intestine . . . . .	2	Peritoneal adhesions, tubercles, &c. . . . .	9
Internal herniæ :		Stricture of sigmoid flexure . . . . .	10
Inguinal high up . . . . .	1	Ditto colon . . . . .	11
Diaphragmatic . . . . .	2	Ditto rectum . . . . .	11
Meso-colic . . . . .	2	Intussusception . . . . .	24
Obturator . . . . .	3	By bands, adherent diverticula, uterine appendages, &c. . . . .	36
Fæcal accumulations . . . . .	3		
Twist of sigmoid flexure . . . . .	4		
Concretions, calculi, and foreign bodies . . . . .	7		
	—		
	26		Total 135

The *order of frequency*, as to different causes of obstruction at various ages, showing the liability of different periods of life, may be thus stated; in regard to youth, middle life, and old age. In *youth*; from internal strangulation by bands of lymph, omentum, or adherent diverticula, from adhesion of coils of bowel to each other, from intussusception, from foreign bodies taken by the mouth, from cancer rarely, and hitherto found in the rectum only;—in *middle life*; from twists of large or small intestine, from gall-stones, intestinal concretions, and foreign bodies, from intussusception, from simple stricture, from mesenteric hernia, from internal strangulation by bands, &c., from peritonitis often resulting in abscess, from simple constipation, from cancer;—in *advanced life*; from cancer, from thickened intestine the result of old reducible hernia, from intussusception, from simple stricture, and lastly, from internal strangulation.

*Symptoms, and Diagnosis.*—Certain symptoms are common to intestinal obstruction arising from any cause. And, whether it be acute or chronic, these symptoms are the same, differing or rather varying only in degree. No definite line of distinction can be drawn between the symptoms in either degree; the acute subsiding into the chronic, and in this state becoming acute in their severity. Hence, the condition, or cause, of obstruction cannot be invariably inferred from the greater or less severity of the symptoms, as the ground of diagnosis. The general symptoms of intestinal obstruction are; pain in the abdomen, and localized more especially in some particular part, with abdominal distension, constipation and vomiting, followed sooner or later by collapse.

In the *acute form* of these symptoms, intussusception or invagination of the bowel, at some part of the intestinal canal, as the most common cause of obstruction, will illustrate their usual course. The upper portion of intestine slips into the lower, at the seat of invagination. The patient is struck with abdominal pain, sudden and often acute, which is referred to the seat of injury, perhaps the lower part of the belly; and he seems conscious that something has happened within the abdomen. Flatulent swelling supervenes, with much rumbling and rolling of the intestines; a commotion which can be felt and perhaps seen, and traced up to a part of the canal where it ceases. That is the seat of invagination. A constant desire to relieve the bowels is experienced, and frequent efforts are made to do so; but the constipation is obstinate, and nothing passes, or only a little wind and a lump or two of hardened fæces, or a little mucus mixed with blood, may be strained out;

not unfrequently, pure blood, fluid or clotted, is discharged. Vomiting soon sets in, at first of the contents of the stomach, and then speedily stercoraceous matter. This state continuing and increasing, the patient's anxiety and distress are aggravated. His restless endeavours to force a passage by stool, in the vain hope of obtaining relief, the accumulating abdominal distension, and pain heightening to agony; constitute a picture piteous to behold. At length prostration ensues, with some abatement of the symptoms but of a delusive character; the victim sinks exhausted in a few days, usually in about a week or ten days at the latest. Death is consequent on the exhaustion, coupled with gangrene and peritonitis.

In *chronic* obstruction, stricture of the bowel, and commonly of some portion of the large intestine, as of the sigmoid flexure or of the rectum, is attended with similar symptoms; but they are less speedily developed and less marked. Progressing inability to relieve the bowels, and narrow constricted, or flattened motions dwindling down at length to constipation, with nausea and then vomiting less early stercoraceous; are succeeded by tympanitic distension and pain. Death may not occur for weeks or months, recovery takes place when least expected.

The *diagnosis* as to the particular *cause* of obstruction cannot be positively determined by any known special symptoms, except perhaps where the seat of obstruction is low down near, or in the rectum. Nor, with regard to more internal obstructions, is the structural condition so important practically, as its particular *seat*,—the portion of intestinal canal affected. To discover this point, a most careful and thorough examination of the abdomen should be made externally; and an exploration internally as far as possible, through the passages,—the rectum, and the vagina in the case of a female patient.

The diagnostic symptoms in the principal different conditions, acute and chronic, may be thus stated. In *intussusception*, the chief signs are; the fixed pain and the distension, with tenesmus and bloody mucous stools, probably also the detection of an intumescent tumour, and the early age of the patient. In *volvulus* or *twisting* of the bowel, the abdominal distension may be very unsymmetrical; great tympanitis on one side, and flattening on the other, with the symptoms of internal strangulation. In *internal hernia*, the suddenness and marked severity of the symptoms, are somewhat distinctive. In *chronic stricture*, the converse character, and the order, of the symptoms as just described.

Examination per rectum can be made with the finger or by means of a bougie or injection. When the stricture is situated low down, it may be reached with the finger, and a more satisfactory exploration made as to the nature and extent of the constriction. *Simple* stricture is limited usually to a circular band, having a sharp margin around the aperture which communicates with the intestine above. *Cancerous* stricture extends along the rectum, and presents considerable thickening and an irregular or nodulated surface. If a bougie be introduced, it must be passed up with great caution and no degree of force, as frightful damage might, and has been done by misadventure. An injection of warm water may be immediately returned or only partially retained, thus plainly declaring the presence of a stricture; especially if the return current should wash away with it any feculent matter, lodged below the obstruction.

*Treatment*.—The general indication of treatment in intestinal obstruction—from whatever cause arising—is plain enough; namely, to restore the continuity, and the normal action of the bowel. But how to ac-

comply with this object, is always a question of difficulty? Its rational fulfilment would first imply, the previous detection of the causative condition in operation,—as to its nature and seat. This precision of diagnosis cannot, as we have seen, generally be attained. So we must be guided by more general rules of treatment. Too often these are ineffectual or impracticable.

*Medicinal* measures have regard to restoring the normal action of the bowel, and allaying the excruciating pain and inflammation, more particularly incident to acute obstruction. An absolutely negative rule is never to administer purgatives; *i.e.*, medicines by the mouth, to force evacuation through the obstructed portion of the intestinal canal. Enemata may generally be used with advantage, oft repeated and copiously, especially if the obstruction is apparently the result of constipation. Mild enemata are most serviceable, as simply of warm water; their mechanical action being more effectual than any specifically aperient action. The injection of air or inflation, by means of the stomach-pump, has occasionally proved effectual in overcoming the obstruction, and thus restoring the natural action of the bowel. As the intestinal canal becomes inflated, something is felt to give way suddenly, and a motion soon follows. This practice has been most successful in apparent intussusception, and as occurring in infants and children. Opium is the most efficacious agent for the relief of pain, and it exercises some remedial influence on peritoneal inflammation. But with symptoms of peritonitis, calomel may be combined with opium, and leeches, followed by hot fomentations should be applied to the abdomen. Solid food, of any kind or in the smallest quantity, must be rigorously prohibited, the patient should be supported entirely by the imbibition of fluid nourishment; and this injunction is scarcely less applicable if the obstruction has yielded, and the bowel lies as yet disorganized or functionally paralysed.

When medicinal treatment has failed, the question of *operative* interference arises. It is a dire resource, almost as perilous as the condition sought to be removed. Yet it is justifiable as affording the only chance of saving life, in a state otherwise inevitably fatal. The period of obstruction when such surgical intervention becomes warrantable, cannot be determined absolutely. As a general rule, that laid down by Phillips, should be observed; recourse to operation after three or four days have passed, without any relief from ordinary means, constipation being complete and stercoraceous vomiting persistent. Constipation alone will not justify operative interference, unless the obstruction be complete; but with vomiting as a symptom of internal strangulation, an operation is the only alternative between probable life and certain death. Intussusception may be taken as an exception, owing to the pathological condition of the invaginated portion of intestine, the resultant sloughing and separation of that portion of the bowel. Moreover, the following self-curative results are interesting:—in 24 cases of intussusception, occurring at various periods of life, from two months and a half to fifty years of age; 13 of the patients died unrelieved, some as early as three days, some as late as forty days, from the commencement of the symptoms. But in the other 11 cases, the invaginated pieces of intestine sloughed and were passed by stool. Of these cases, only 2 died soon after the passage of the slough; the remaining 9 entirely recovered. The patients who recovered were ill for periods varying from five to thirty days, and their ages ranged from six to fifty years.



An operation for the relief of intestinal obstruction will vary in its situation and design according to the seat and nature of the obstruction.

In respect to the *small* intestine, the abdominal wall, and thence the peritoneum, must necessarily be opened, in order to reach the seat of obstruction. Thus may be relieved; obstruction of a hernial character, whether depending on a constricting band, or the gripe of a fissure in the omentum or mesentery through which a coil of intestine has slipped; or a volvulus of the bowel may be untwisted. Least successful will be the operation in the following conditions; when peritonitis has supervened from prolonged strangulation; in the obstruction from foreign bodies or calculi lodged in the bowel; and in stricture of any portion of the small intestine.

*Gastrotomy or the Abdominal Section* may be performed in the following manner. The arrangements resemble those of ovariectomy in the female. The temperature of the apartment should be raised to about 70° Fah., and flannels wrung out of warm water be at hand to protect the bowels; the bladder emptied, and chloroform administered. Then, the Surgeon, standing conveniently between the legs of the patient recumbent, makes an incision, usually in the middle line below the umbilicus; or elsewhere, over the seat of obstruction, when that can be diagnosed by an intumescent tumour. Proceeding cautiously towards the peritoneum, this membrane is carefully slit up by a probe-pointed bistoury guarded by the fore-finger beneath. Any protruding coils of inflated intestine are then to be gently drawn aside by an assistant using the wet flannels, while the operator searches carefully upwards along the empty coils of the bowel until he arrives at the source of obstruction. A constricting band may then be divided cautiously with the scalpel or broken through with the finger; a portion of intestine may be withdrawn from a fissure in the omentum or mesentery, or a twisted portion of bowel may be untwisted. In the event of not thus releasing the bowel in any case; as a last resource, it might be opened as low down as possible, and the aperture stitched to the integument of the abdominal wound, with the hope of establishing an artificial anus. Otherwise, under ordinary circumstances, the bowels should be returned, and the abdominal incision closed by the interrupted suture, supported by a compress and bandage. After-treatment must be conducted on the general principles relating to abdominal wound with peritonitis.

Obstruction of the *large* intestine may be treated by operation, through the abdominal wall, in either iliac region; or in either lumbar region.

The design of any such operative procedure is, however, not to overcome the obstruction, commonly a stricture in some portion of the large intestine; but to relieve constipation by forming an artificial anus. Of course, therefore, the bowel must be opened and above the seat of stricture. Hence, stricture of the rectum or of the sigmoid flexure of the colon, will necessitate an opening of the *descending* colon; or in the former case, the *sigmoid flexure* might be opened; and stricture of the descending or of the transverse colon, will require a transference of the operation to the *ascending* colon, or to the *cæcum*.

These four sites of operation have, however, different advantages; not as to their respective eligibility for access to the bowel operated on, but with regard to not implicating the peritoneum. In both the operations pertaining to the sigmoid flexure and the cæcum; an opening is made in the iliac region, left or right, whereby in either case, the peritoneum must

be wounded; whereas, in both the operations on the colon, or by colotomy as it is termed, the bowel is reached in the lumbar region, left or right, and the peritoneum may be avoided.

The *iliac* operation was first suggested by Littre in 1710, who recommended that the sigmoid flexure of the colon might be opened from the left iliac region; but Pillore, a Surgeon of Rouen, first performed the corresponding operation in 1776, by opening the cæcum from the right iliac region. Both these were cases of stricture of the rectum. It may here be added that, the *transverse* colon has been opened, in one case, for stricture of the rectum; an operation performed by Fine of Geneva, in 1797.

The *lumbar* operation was proposed by Callisen, in 1796; and he performed it on the descending colon, in the left lumbar region; the subject being the dead body of a child. In seeking the intestine, he accidentally missed the cellular interval uncovered by peritoneum, and wounded this membrane. The operation was thenceforward deemed impracticable, and not attempted on the living body. Amussat revived it in 1839, and extended this procedure to the ascending colon, in the right lumbar region; modifying also the line of incision from a vertical incision, which Callisen had recommended, to a transverse one. Certain advantages are thus gained; it makes the operation easier and more certain, and avoids the danger of dividing the lumbar vessels and nerves; it facilitates finding and opening the intestine between the duplicature of peritoneum, without wounding the serous membrane; and it enables the operator to establish the artificial anus more anteriorly.

*Colotomy or Amussat's operation.*—The guide to the incision, is the interval between the crest of the ilium,—its middle third, and the last false rib, and external to the outer margin of the erector spinæ muscle. Commencing just in front of the last-named boundary, an incision is carried forwards transversely, corresponding to the middle third of the iliac crest, and to the extent of from four to six inches. The muscular layers of the abdominal wall are then successively divided, and perhaps the external border of the quadratus lumborum muscle. Clearing away the areolo-adipose tissue, which is sometimes membranous and semi-transparent resembling peritoneum; the colon presents itself, and the more so if loaded; it appears at the bottom of the wound, and free of peritoneum. It is recognised by its muscular character, somewhat greenish colour, and distended sacculated appearance; and the more fully the gut is engorged, the more freely will it have uncovered itself through the duplicature of the peritoneum—the meso-colon. The gut should be hooked up with a tenaculum, avoiding the peritoneum on either side, and drawn well out to the surface of the wound; in order to prevent any feculent effusion into the cellular texture, as the gut gradually collapses by discharging its contents when opened. An aperture is then made with a bistoury, and there usually takes place a gush and copious flow of feculent fluid. Basins should be at hand to receive the abundant evacuation. The margin of the opening in the colon is then secured to the integumental incision, by means of a few points of suture; so that an artificial anus thus formed may become established permanently. After-treatment consists, in combating collapse and peritonitis. Opium and support are the principal constitutional requirements; and scrupulous cleanliness is the most urgent local observance to be attended to. The constant discharge of fæces through the wound may generally be controlled by the use of an ivory ball, fitting the aperture in the bowel, and attached to a small shield, over

which a soft thick piece of india-rubber should be fastened; the whole contrivance being retained in position by a bandage.

This operation has now been resorted to about fifty times. Its results may be gathered from the analysis of 44 cases, in which an artificial anus has been formed by opening the large intestine. From a paper by Mr. Cæsar Hawkins, published in the *Medico-Chirurgical Transactions*, vol. xxv.; it appears that of these 44 cases, in 17 the anal opening was made through the peritoneum, and in 26 behind that membrane; but as 5 of the peritoneal sections were exceptional cases, 12 only are left to compare with 26 cases of operation behind the peritoneum. Of the former, 7 died and 5 recovered,—the recoveries amounting, therefore, to only 41 per cent.; whereas, of the 26 cases of unopened peritoneum, 10 died and 16 recovered,—the proportion of recoveries amounting to 61 per cent. In all these cases, the large intestine was the seat of operation: it was performed on the *right* side in 10 instances; in 4, the right colon and cæcum were opened through the peritoneum, and all of these cases were fatal; whilst of the remaining 6, in which the right colon was opened *behind* the peritoneum, 4 recovered. The advantage, therefore, on the right side, is in favour of the lumbar, or Amussat's operation. On the *left* side, however, the results are less favourable. Of 8 cases in which the left colon was opened through the peritoneum, 5 recovered and 3 died; whilst of 20 cases in which the *lumbar* operation was performed, 11 recovered, but 9 were fatal.

Respecting then any operation for the formation of artificial anus in intestinal obstruction, affecting the large intestine; these results well deserve serious consideration.

## CHAPTER LV.

### PARACENTESIS ABDOMINIS.

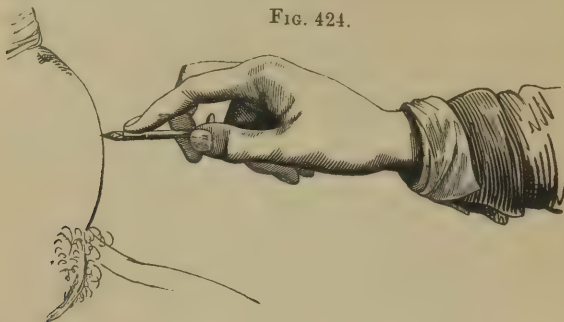
IN dropsy of the abdomen; whether ascites or ovarian, the peritoneal sac, or an ovarian cyst becomes distended with fluid; and either cavity may be emptied of its contents by *Tapping*.

This is a very simple operation. The bladder having been emptied, the patient should be seated on the edge of a chair, or, if very weak, turned sideways to the edge of the bed; so that in either position the protuberant belly shall be exposed. A flannel roller, or a jack-towel, the breadth of the abdomen from above downwards, is then passed round, and the ends crossing behind the loins, are given in charge of an assistant on either side. They should draw the roller equably, to compress the abdomen uniformly, as the water flows. A small aperture is cut in the roller, corresponding to the point where the abdominal puncture is about to be made; namely, in the middle line, about two or three inches below the umbilicus. The Surgeon seating himself before the patient, as placed in the sitting posture; he makes a small vertical incision at the spot indicated, and through the integumental wound thus made, a large-sized trocar and canula is thrust into the abdomen. (Fig. 424.) Or the thrust may be made at once, without any preparatory incision, the skin yielding without any appreciable damage to this texture. On with-



drawing the trocar, taking care that the canula do not slip out after it, the fluid spouts out in a full stream, and is received into a pail below. A convenient and more elegant arrangement, is the adaptation to the canula, of a tube of india-rubber, provided with a stop-cock. The kind of fluid varies in colour and thickness; in ovarian dropsy, it is commonly of a brownish coffee-colour, turbid, and thick or of almost glutinous con-

FIG. 424.



sistence between the thumb and finger, and it froths up as the stream continues. The assistants should draw the roller firmly, and especially as the stream weakens and dribbles, when air might pass back into the peritoneal cavity. Towards the last, the fluid may be tinged with blood, owing apparently to the mouth of the canula impinging on the visceral layer of peritoneum. Then, unless by further traction, the stream can be resumed, the canula should be withdrawn.

The patient may become faint, as the fluid-pressure on the abdominal vessels diminishes; when a little brandy-and-water or wine may be administered, and the orifice of the canula stopped with the finger for a while. Sometimes the fluid suddenly ceases to flow, a bit of intestine coming in contact with the end of the canula, or the tube being blocked up; in either case, the obstruction may be removed by introducing a piece of bougie or other blunt-pointed tube.

On withdrawing the canula, a small strip of adhesive plaster will suffice to close the abdominal aperture. A broad bandage should, however, be well applied round the abdomen to maintain compression; thus preventing faintness, and possibly the reaccumulation of fluid or recurrence of dropsy.

This operation may be modified according to circumstances; any other convenient situation may be chosen for the puncture, provided that there be no tympanic resonance to indicate the presence of intestine, but the dulness on percussion of a fluid collection; and the course of the epigastric vessels must also be avoided. The intestine,—a portion of jejunum, has been wounded, and yet the patient recovered. This accident occurred in a case communicated by Mr. Gay, to the Pathological Society, and which is recorded in the second volume of the Society's Transactions.

## CHAPTER LVI.

## DISEASES, INJURIES AND MALFORMATIONS OF THE RECTUM, AND ANUS.

DISEASES of the Rectum and Anus pertain to the terminal portion of the large intestine, in its limited course of six or eight inches from the left sacro-iliac articulation to the anal orifice in the perineum.

Surgically considered, the rectum might almost be said to have a more limited extent,—in regard to its liability to disease. At its commencement, the bowel inclines downwards and inwards to the middle of the sacrum; thence it curves forwards in front of this bone and the coccyx,—behind the bladder, vesiculæ seminales, and prostate, in the male, or the cervix uteri and vagina, in the female; and opposite the tip of the coccyx, or the prostate anteriorly, it inclines downwards and backwards to the anus,—leaving an interval between this portion of the bowel and the membranous part of the urethra and its bulb. It is in these two latter portions of the gut, or in about the lower half of its whole extent, that most rectal affections are congregated; and they derive some additional importance from the relative position of the bladder and prostate gland.

Diseases thus crowded together, may be most conveniently arranged according to their pathological association and diagnosis, observing also their order of frequency in the practice of this branch of Surgery. Affections of the rectal tube and of its anal aperture will, therefore, be considered as follows:—Inflammation and Rectal Abscess; Fistula in Ano; Ulcer of the Rectum, and Fissure of the Anus; Hæmorrhoids—external, internal, and Prolapsus of the Rectum; Polypus of the Rectum; Stricture of the Rectum—Simple, Cancerous; Rectal Fistula,—Vesical, Vaginal; Anal Tumours; Anal Contraction; Injuries; Foreign bodies; Congenital Malformations; Functional Disorders.

INFLAMMATION AND RECTAL ABSCESS.—In the loose cellular texture around the rectum, and particularly in that of the ischio-rectal fossa on either side of the anus, inflammation is very apt to occur, and speedily pass into suppuration. According to the situation of the abscess thus formed, it is more or less deep-seated or superficial; but in either case, the matter has a tendency to burrow upwards in the direction of least restraint,—the pelvic cellular tissue leading from the ischio-rectal fossa, beneath the levator ani muscle, rather than towards the thick and unyielding integument continued from the buttock over the fossa.

The *symptoms* of rectal abscess are, not unfrequently, indistinct. Pain is felt in the fundament, more especially on passing a motion, and if the *faeces* be hard and irritating. The pain has the usual throbbing character when matter forms; though sometimes this takes place without scarcely any sensation, but that of a dull aching weight as matter accumulates. Hence, two varieties of abscess may be recognised,—the *acute* and the *chronic*. In both, there will be some tenderness on pressure, on one side of the anus; swelling also sooner or later becomes apparent, which is hard and brawny though perhaps softer at one point. In connexion with these local signs, other symptoms may be present; a constant bearing down and desire to relieve the bowel, yet with straining efforts, only a little mucus passes; or there may be obstruction to the evacuation of

æcæ, and constipation; while a troublesome irritability of the urinary bladder and frequent micturition is experienced, or a difficulty in passing water and even retention of urine. The situation of *pointing* is various, and specially important. Rectal abscess coming to the surface, points slowly in the perineum by the side of the anus; occasionally, however, at some distance from the bowel,—in the middle of the thigh, or backwards, near the trochanter; but, not unfrequently, it opens into the bowel, and perhaps also externally in the perineum. Fistula in ano results when any opening of a rectal abscess becomes established in the neighbourhood of the anus; and the varieties of fistula thus formed will be noticed presently. The matter discharged from an abscess adjoining the rectum has always a fæcal odour; more perceptible if there be a communication with the bowel, although it is distinctly fæcal in any case, owing probably to transudation.

*Causes.*—Various local causes give rise to this abscess; any source of irritation,—as habitual rectal constipation, or a foreign body in the bowel, as a fish-bone which Liston found, the core of an apple which Brodie detected, or a piece of tooth; occasionally, caries of an adjacent bone, as of the coccyx or sacrum, or of the tuberosity of the ischium in one of my own cases; or disease of the bowel itself may be the cause in operation; lastly, some external injury, as a kick or contusion, may have induced inflammation; or exposure to cold, as by sitting on a cold stone, have brought about congestion followed by suppuration. Chronic rectal abscess not unfrequently results from obstruction to the venous circulation, and is symptomatic of some organic disease of the lungs, liver, or heart. Often, as chronic abscess co-existing with a phthisical tendency or actual phthisis, the local disease is of constitutional origin. Whenever dependent on venous obstruction, congestion of the hæmorrhoidal veins, or piles, is commonly associated.

*Treatment.*—In an early stage, before suppuration has occurred, resolution can sometimes be effected. Laxative aperients rather than purgatives, and careful regulation of the diet, with warm fomentations, may succeed in dispersing the inflammation. If not thus serviceable, these measures will prepare the way for the better management of suppuration. An early opening should be made to prevent the matter burrowing around the gut. As soon, therefore, as the formation of matter can be detected or suspected, although fluctuation be very indistinct, and certainly before any pointing has appeared; a sharp-pointed bistoury should be entered carefully by the side of the bowel, and if a drop of pus rises up by the side of the blade, the opening must be sufficiently enlarged downwards to let out the matter already accumulated and allow a free discharge subsequently. A strip of lint is then inserted. The abscess may heal from the bottom, without communicating with the bowel or leaving an external fistula.

**FISTULA IN ANO.**—Any pus-secreting tract which passes up by the side of the anus, is designated, from its proximity, a fistula in ano. It results from the contraction and partial closure of an ischio-rectal abscess, leaving only this narrow channel. Commonly, it opens both internally, into the bowel, and externally in the vicinity of the anus; sometimes, there is but one orifice,—an external, or an internal. Corresponding conditions of fistula may, therefore, be recognised.

*Complete* fistula has two openings; one into the bowel, another on the surface of the skin. *Incomplete* or blind fistula has but one opening; an



external opening on the skin, but no communication with the bowel,—constituting *blind external* fistula; or there may be an internal opening into the bowel, but no opening on the skin,—constituting *blind internal* fistula.

These fistulous openings have some features worthy of notice. The *integumental* orifice is situated usually over the fossa by the side of the anus; but it may be removed to some distance outwards and posteriorly at the back of the buttock, and towards the great trochanter. In point of size, the orifice is smaller or larger, admitting only a probe or a director easily; it has a puffed everted appearance, with perhaps protuberant granulations indisposed to close, and moist with a constantly oozing, fetid, purulent discharge. Sometimes, there is more than one fistulous opening, even several, resembling a water-pot spout, and all discharging matter. These orifices are scattered in various directions contiguous to the anus; and lead by very tortuous, devious, routes to the abscess, and thence to the bowel; branch sinuses, perhaps, passing off from these fistulous tracts. On either side of the gut, also, one or more fistulous openings may have formed. The *rectal* orifice varies chiefly in its height up the bowel. Commonly, it is situated just above the sphincter ani, where the rectum enlarges, especially in old people and females; this opening is, however, not the termination of the fistula, which usually runs up further outside the bowel into a cul-de-sac. It has been affirmed by some of the best authorities, that the inner orifice of fistula in ano is never higher up in the bowel than about the spot referred to. Mr. Ribes in 1820, and previously, I believe, Sabatier held this opinion; it was supported by Sir B. Brodie and Mr. Syme, and the special observations of Dr. Bushe of New York tend to the same conclusion. On the other hand, Mr. Curling disproves this conclusion, and although Mr. Quain does not take up the question in his clinical lectures on Diseases of the Rectum, yet the facts there stated are equally opposed. In Case 29 of these lectures, the inner opening was situated more than two inches up the rectum, and equally high up in Case 32. I may add, that in a case of complete fistula, on which I operated, the inner orifice was three inches from the anus.

The *diagnosis* of the three conditions of fistula in ano, is very obvious. Complete, and blind external fistula, both present an external opening by the side of the anus, or otherwise placed. But on passing up a probe or director along the course of the fistula to the bowel, the fore-finger of the other hand having been introduced into the gut to feel for the point of the instrument; in the one condition of fistula, an opening is discovered through which the probe can be made to touch the finger,—no septum intervening; in the other condition, the point of the probe may be felt more or less plainly through the thickness of the bowel, but not in contact with the finger,—a membranous septum, however thin, always intervening. Blind internal fistula is less readily detected. There may be some brawny swelling and tenderness on pressure externally, but no opening; a purulent discharge occasionally from the interior of the bowel, and the escape of pus on pressure over the ischio-rectal fossa, will both lead to the diagnosis of an internal fistula; and this will be confirmed by feeling the orifice in the gut, when the finger is passed into the anus.

The relation of fistula in ano to rectal abscess has been disputed. Abscess is said to occur first, external, to the bowel; then opening into it, and, outwards by the side of the anus, a complete fistula is thus constituted. If the abscess opens only externally, a blind external fistula

results. This mode of fistula formation I have already alluded to, and it is that which Mr. Syme maintains. Conversely, ulceration of the mucous membrane of the bowel is a reputed mode of origin; and leading to the formation of an opening, and an abscess externally,—a blind internal fistula is thus constituted, which may result in complete fistula. This was the opinion held by Sir B. Brodie. In the one mode of formation, abscess precedes and causes, in the other, it follows and results from,—the formation of an opening in the gut. Doubtless, fistula originates in both ways. Blind external fistula—not an uncommon condition—must necessarily arise by an abscess independent of the rectum, there being no communication with the bowel. The particular way in which fistula arises, is determined probably, by the causes of rectal abscess. Any occasion of irritation or of venous congestion, external to the bowel, will probably produce abscess in that situation, followed by fistula; any impaction of feces or a foreign body in the rectum, will probably produce ulceration of the mucous membrane, followed by some amount of feculent extravasation into the surrounding cellular texture, and abscess as the result of this irritation.

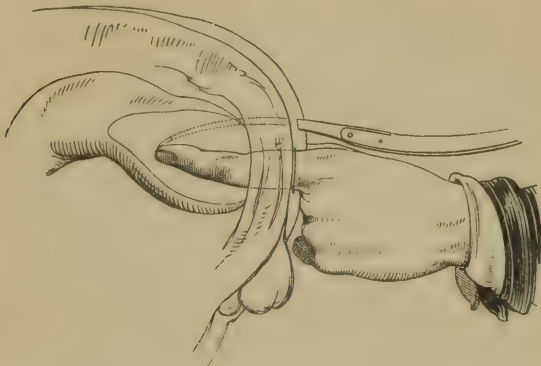
The *prognosis* is unfavourable in proportion to the organic or constitutional origin of the disease; as in fistula arising from venous congestion, and dependent on some organic disease of the heart, liver, or lungs,—especially phthisis.

*Treatment.*—An *operation* is usually the only means of cure. Such interference is contra-indicated, whenever fistula depends on some persistent cause. Operation would then be either useless or prejudicial,—it would fail to cure the disease, or, being thus successful, it would develop the causative condition into greater activity. Therefore, operative interference, for the cure of fistula, should not be had recourse to,—in fistula connected with any persistent local condition, as disease of the rectum, or caries of the sacrum or coccyx; and still less, when it is dependent on some constitutional condition, advanced phthisis in particular. In this disease, the drain by constant discharge from the fistula might seem to aid in reducing the general health; but its derivative influence on the pulmonary disease is a more important consideration.

No principle of treatment is more simple than that of the established operation for fistula in ano; and no operative procedure is generally more easily performed, or is more effectual. The principle is simply this,—that the fistula being kept open by the almost constant action of the adjoining sphincter ani muscle, division of this muscle will set the part at rest, and allow it to heal and close from the bottom. Accordingly, the bowels having been well cleared with castor oil or other mild aperient medicine, and the rectum emptied by an enema on the day of operation; the patient is laid on the side most convenient to the operator, the thighs are drawn up so that the buttocks shall project over the side of the bed or table, and the latter held apart by an assistant. A probe, or director, introduced through the external opening in the skin, will guide to the internal opening, should it exist, or to a spot where the bowel is thin and about to give way. At the same time, the fore-finger of the other hand is introduced into the rectum until it rests upon or feels the point of the director. A curved, narrow-bladed bistoury, blunt-pointed or sharp-pointed, according as the fistula is complete or incomplete, is then slid through the external orifice of the fistula, along the groove of the director, until it touches the point of the finger in the rectum (Fig. 425); when

the fistulous tract is laid open freely into the bowel—the knife dividing at one sweep, the skin, sphincter and bowel, and coming out of the anal aperture, with its point still resting on, and protected by, the point of the finger. It will be observed, that the cul-de-sac, above the opening of the bowel, is left undivided in the operation as thus described. Its division is

FIG. 425.



unnecessary, to fulfil the principle of the operation, and might implicate branches of the middle hæmorrhoidal artery, producing serious hæmorrhage. This terminal portion of the fistula generally closes, with the open tract, now that the sphincter ani is divided and set at rest. If one or more branch sinuses exist, they also must be laid open.

Complete fistula, and blind external fistula, are thus operated on. Blind internal fistula presents no external orifice; a bent probe must, therefore, be passed up through the anus, and diverted into the rectal opening, thence downwards to the integument. When its point is plainly felt projecting, a puncture should be made with a sharp-pointed bistoury and the operation completed in the usual manner.

In performing the operation for fistula in ano, with the ordinary bistoury, two accidents are liable to occur, as contingent on the construction of the instrument—an unprotected knife. Its *sharp* edge—so keen, as Pott observes—may pass out of the fistulous tract; or the point, necessarily *sharp*, in the absence of an inner opening, may pass out, instead of penetrating the bowel. Both these accidents are liable to happen in the act of sliding the knife through the fistula; particularly if the tract be long, narrow, and tortuous; while misdirection of the point may occur, more especially in blind external fistula. Moreover, there is the embarrassment caused by the additional thickness of the director in the fistulous tract, whenever this instrument is also indispensable—*i.e.*, in precisely the above-named conditions. To obviate any risk of either of these two misadventures, and of the mechanical embarrassment; I, some years ago, invented a knife, which has an ensheathed blade, and is hence denominated the “concealed fistula-knife.” It has the appearance of an ordinary director, set in the handle of a scalpel. This director is introduced through the fistula into the bowel, when by depressing a button on the back of the handle, the instrument is *then* converted into a knife, having a sharp point, which can be passed through the bowel, if the fistula be incomplete;



and the operation finished in the ordinary manner. One instrument, therefore, suffices to begin and complete the operation, and by a more simple, speedy, and safe procedure. I have operated with this concealed knife many times, and under circumstances of some difficulty; always with ease, and with an in-and-out-again movement, not otherwise safely practicable.

In concluding the operation, a narrow strip of oiled lint should be passed up the bowel, into the cul-de-sac when it exists, and laid within the wound of the open fistulous tract. Thus healing and closure by granulation, may take place from the bottom. But it will be unnecessary and undesirable to continue this lint-tent longer than the first two or three days. If its application be unduly prolonged, the wound may become a chronic granular cleft, indisposed to contract and cicatrize; or it heals, leaving a gap, and a weakened state of the sphincter muscle with a tendency to the involuntary escape of *fæces* and *flatus*. This latter state I have known to remain for five or six years after the operation; and it is usually unavoidable to some extent in the after-management of an operation, when the fistula itself was extensive, chronic, or both. The discomfort and misery entailed by the perpetual liability to feculent discharge, may be almost worse than the original fistula; usually, however, the sphincter gradually regains its strength and the power of retention is restored. But I know of no operative resource for substituting an efficient contraction of the anal aperture.

*After-treatment.*—The bowels having been thoroughly emptied before operation, no action may take place for two or three days; any liability to disturbance must be restrained by opium, and then the gentlest aperient—castor-oil, should be administered. Hæmorrhage rarely proves troublesome. At the time of operation occasionally, bleeding may be such as evidently to require special means to arrest it; the wound should be plugged with lint to the bottom, and a compress applied, secured by a T bandage. Then, the patient should be watched, lest hæmorrhage continuing internally and the blood passing up the bowel, a large quantity might be lost imperceptibly. Secondary hæmorrhage, occurring in the course of a few hours, must be treated in like manner; the clots removed, ice-cold water injected, and a plug introduced well up the bowel. The wound heals usually in two or three weeks. If sluggish and indisposed to close, the healing process seems to be assisted by the administration of the *confectio piperis nigri*, in drachm doses, at bed-time.

*Ligature* of the septal portion of bowel, has sometimes proved successful. This operation has of late years been strongly advocated by Mr. Luke. A horsehair, or flexible wire ligature is passed, by means of an eyed-probe, through the fistula into the bowel; the two ends are tied, and adapted to a small screw. The ligature is tightened, as it ulcerates its way through the septum; in a week or two it becomes detached, the fissure at the same time granulating from the bottom. One advantage attends this method of dividing the fistula, hæmorrhage is less likely to occur. Ligature may, therefore, be more appropriate than cutting with the knife, in deep fistula; where that operation might implicate the middle hæmorrhoidal artery. But, in long, narrow, and tortuous fistula, the introduction of a ligature will scarcely be practicable; and in any case, this method of cure is tedious and painful.

*Stimulant application* to the fistulous tract, is also an occasional mode of cure, by inducing contraction and closure. This, however, is limited

to blind external fistula, of short extent, and free from induration. Such application may be made, either by means of irritant injections, as tincture of cantharides or tincture of iodine, used daily; or by passing up a probe armed with fused nitrate of silver. In the course of this treatment, the general health must also be improved by medicinal and hygienic measures.

*Double* fistula in ano requires a double operation, if the fistula be complete on both sides; and both may be advantageously slit up at the same time. Double *sinuses* with only one internal orifice, must both be laid open; but the operation should be completed only on the side where the inner orifice exists, leaving the bowel untouched on the other side.

ULCER OF THE RECTUM, AND FISSURE OF THE ANUS.—These two conditions may exist separately, or co-exist. *Ulcer* of the rectum is situated just within the sphincter ani, and usually posteriorly. Extending outwards, perhaps, to the anal aperture, it is commonly associated with a small external hæmorrhoid or pile, beneath the base of which the terminal limit of the ulcer lies concealed. Thus extended, the ulcer is situated partly within the rectum, just above the ring of the sphincter muscle; and partly within the circumference of the anal aperture, approaching the condition of fissured anus. The ulcer varies in size, from a large pin's head to a large split pea; and when distended has an ovoid or circular shape; its surface is smooth, or rough when relaxed, and the colour may be reddish or sloughy-ash grey. Two ulcers are sometimes found.

*Fissure* of the anus is situated at the anal aperture—the junction of the mucous membrane and integument; and not involving the rectum. It consists of a crack or streak of excoriation, somewhat indurated, and placed between the loose folds of mucous membrane and integument which surround the anus. An overhanging pile is commonly associated with fissure. Two or more such fissures also not unfrequently occur.

The *Symptoms* of these ulcerative affections are easily recognised. Both states are acutely painful, out of all proportion to the limited extent of structural lesion, and as it continues, the constantly recurring suffering gives a remarkably haggard and pallid expression of countenance; both states also, especially rectal ulcer, are attended with more or less spasmodic contraction of the sphincter, and with some irritability of the urinary bladder, a tendency to spasmodic stricture and seminal emissions. *Spasm* of the sphincter has been regarded as a peculiar and independent affection—such is the opinion of Copeland and Syme; it is more probably, as Mr. Quain alleges—secondary and sympathetic.

Proceeding to *diagnosis*:—with ulcer of the rectum, sometimes distinguished as “painful” and “irritable” ulcer, there is most acute burning pain in passing a motion; the suffering increases after the act, and continues for a considerable period, varying from a quarter of an hour to several hours and then subsiding into ease until the bowels are again moved. With fissure of the anus, there is smarting or even equal pain, as a motion passes; but it subsides within a few minutes, when the temporary irritation has ceased, and the more readily if the part be sponged and cleansed properly after the act. Then again, some amount of bloody-purulent discharge may be observed in both ulcerative affections; but in that of the rectum, there is no external appearance of ulceration, unless the part be protruded and carefully examined; yet the ulcer can be felt and seen. On introducing the finger just *within* the anus, and generally

towards the coccyx, a small depressed surface can be detected; touching this spot causes sharp, burning pain, and provokes a more powerful spasmodic contraction of the sphincter around the end of the finger. By examining the rectum with the speculum ani (Fig. 426) the ulcer may be brought into view through the open side of the tube. To facilitate either method of examination, in this, and all other painful affections of the interior of the rectum, the influence of chloroform is an invaluable boon both to the patient and the Surgeon. In fissure of the anus, the ulcer-crack can be discovered by a little careful search *externally*.

Fig. 426.



The *causes* of these ulcerative affections would seem to be; rectal constipation, in the production of ulcer within the bowel, and this may be aided by violent straining defæcation; while the external fissure is probably induced by want of cleanliness, as by gonorrhœal matter coming in contact with the thin sensitive skin around the anus, or by that syphilitic discharge which begets mucous tubercles. Females, therefore, are most liable to such anal ulceration; owing to the proximity of the vaginal discharge, and the easily-cracking nature of their perineal and anal integument. A sedentary occupation predisposes to fissure.

*Treatment.*—In *recent* ulceration and of *slight extent*, a cure may sometimes be effected by stimulant applications, with anodyne suppositories to allay pain; the bowels being well regulated by castor-oil, or other gentle aperient, and scrupulous attention to cleanliness observed after any action of the bowels, or as to any other source of irritation. Accordingly, the ulcerated spot may be touched occasionally with stick-nitrate of silver or a piece of sulphate of copper; and in fissured anus, the caustic must be run along within the crack so as to fairly touch the bottom of the angle. A weak lotion of sulphate of copper, or zinc, acetate of lead, or the black mercurial wash, may also be sponged up, two or three times a day. An anodyne and astringent suppository is highly recommended by Mr. Erichsen, as very efficacious in this and many other painful affections of the anus. It consists of 2 grains of extract of belladonna, 2 grains of the acetate of lead, and 4 of tannin, made up to a proper consistence with a little suet. This may be introduced into the rectum every night and allowed to dissolve there. I have found nothing so soothing, and apparently protective to the ulcer, as a suppository of simply pil. sapon. co, grs. x. The beneficial effect of these topical applications is estimated by the mitigation of pain, and by the ulcerated surface assuming a healthy reddish granulating appearance, and contracting.

In *old-standing* and more *extensive* ulceration, operative interference is the only cure. The old procedure, originated by Boyer, was division of the sphincter ani, so as to set this muscle at rest, as by the operation for fistula in ano. Copeland proved that this deep cut is quite unnecessary; and that the more superficial incision, limited only to the mucous membrane, through the whole length of the sore, is equally curative. This section of the mucous membrane alone, has since been advocated by Brodie, Syme, and Quain; and it is now the established operation for the



cure of ulcer of the rectum and fissure of the anus. The superficial muscular fibres of the sphincter must, however, necessarily be cut, when the ulcer has destroyed the whole thickness of the mucous membrane. Mr. Curling once noticed the fibres of the sphincter at the base of the sore, in which case they would be divided by any incision through the sore.

The operation is easily done, when the anus is thoroughly opened by an assistant. The fore-finger is introduced into the rectum, opposite the sore, and a probe-pointed bistoury slipped up sideways, and planted just above the ulcer or fissure; the blade is then drawn downwards and outwards steadily along the centre of the sore or in the fissure, dividing the mucous membrane—the depth being about the eighth of an inch. It may be advisable that a thin strip of oiled lint should be laid in the wound and retained for a day or two.

The only preparation for this simple proceeding is thorough evacuation of the bowels beforehand; and the only after-treatment requisite is an opiate, to lessen pain and prevent any action of the bowels, followed by a dose of castor-oil in two or three days. The relief afforded by section of the mucous membrane is almost instantaneous, and the patient feeding well, daily regains health and spirits. In the course of two or three weeks, the wound will probably have healed. A slow-healing wound may be advantageously touched with nitrate of silver, and the administration of the confection of black pepper has apparently a beneficial influence. The result of this superficial operation is usually a permanent cure, and with no evil consequences; whereas deep section or division of the sphincter ani muscle, is sometimes followed by loss of retentive power and involuntary defæcation. I have known a patient, in this condition after operation, pass a motion on coming into the consulting room; the contents of the bowel slipping away from him in the mere act of walking or standing.

**HÆMORRHOIDS—EXTERNAL—INTERNAL, WITH PROLAPSUS OF THE RECTUM.**—Hæmorrhoids, commonly called Piles, are essentially an enlargement of the hæmorrhoidal veins, around the anus, or within the sphincter at the termination of the rectum. The pathology of hæmorrhoids will be understood by reference to the anatomical distribution of these veins. Situated between the muscular coat of the rectum and the thin mucous membrane,—in the sub-cellular texture; the hæmorrhoidal veins are naturally large and tortuous, have no valves, and form a looped plexus around the terminal portion of the bowel, just above the sphincter, with branches to the verge of the anus. Hence, these veins are principally submucous, partly subcutaneous. The greater number of them issue in the superior hæmorrhoidal vein, and thence, through the inferior mesenteric vein, enter the portal system; some of the veins, however, issue in the middle hæmorrhoidal vein, and thence, through the internal iliac vein, enter the general venous system. Hence, the circulation in the hæmorrhoidal veins is principally portal, partly systemic.

Hæmorrhoidal affections are commonly named distinctively according to their situation. Thus are recognised surgically, Hæmorrhoids;—subcutaneous and *external* to the sphincter,—around the margin of the anus; or submucous, and *internal*, within the sphincter,—at the termination of the rectum. In the latter situation, enlargement of the veins, forming internal hæmorrhoids, is accompanied with a tendency to descent and protrusion of the overlying mucous membrane, through the sphincter or anal aperture; constituting a form of Prolapsus of the Rectum. Practically considered, it will, therefore, be convenient to describe Internal hæmorrhoids and

this Prolapsus as one disease. The anal cutaneous integument has an analogous tendency to relaxation. The distinctive terms, external and internal Hæmorrhoids, are not always obvious; the one condition merges into the other, owing to the continuity of the hæmorrhoidal veins. Hence, an intermediate variety has sometimes been recognised, named *interœsternal* hæmorrhoids, situated partly within and partly without the Anus.

Pathologically considered, Hæmorrhoids—whether external, internal, or intermediate, are a dilated and varicose condition of the hæmorrhoidal veins; accompanied with more or less relaxation of the overlying mucous or cutaneous integument, of the rectum or verge of the anus, respectively. This state of these veins would, so far, be analogous to that of varicose veins in other parts; as of the spermatic veins in varicocele, or of the saphena vein in varicose veins of the leg. But there is this important peculiarity in Hæmorrhoids; their relation, partly to the general venous system, principally to the portal venous system. And this twofold venous relationship nearly corresponds to the situation of Piles, as external and internal, to the sphincter ani; and hence the usual designation of these affections of the hæmorrhoidal veins, as thus distinguished.

*External* Hæmorrhoids, at first consisting of one or more dilatations of the external hæmorrhoidal veins at the verge of the anus, undergo certain structural changes. The vein becomes thickened and the blood coagulated; thus forming a thickened sacculus enclosing a dark-coloured clot. Or, the dilated vein, containing fluid blood, may burst, and the blood being extravasated into the adjoining cellular texture, it becomes really encysted, no communication existing between the cyst and the vein. Another form of external pile has been described, as consisting of a congeries of small veins of uniform size, without any appearance of cells, and connected by a dense cellular texture. Plastic infiltration of the cellular texture takes place around either form of pile, investing the sacculus or cyst; and hypertrophy of the skin ensues. Ultimately, an old external pile undergoes atrophy or wasting, in respect to its venous constituent, leaving only the integument in the form of a loose pendulous prolongation of skin.

The *symptoms* of external Piles relate to these various stages of progressive development and decline of this hæmorrhoidal affection. It appears, at or near the verge of the anus, in the form of one or more small, rounded, or oblong tumours, which are soft and compressible, and of a livid blue tinge. When largely formed around the anus, a bunch of these venous swellings somewhat resembles Hamburgh grapes, to which they have been compared in appearance. They are accompanied with a painfully depressing sense of bearing-down fulness at the fundament, especially in the standing posture and after any straining effort of defæcation or micturition; heat, itching or smarting, add to the patient's discomfort. A crack occurring, sometimes, at the base of an external pile, the irritation and pain thus occasioned, aggravate the hæmorrhoidal suffering. When coagulation takes place in the sacculated venous dilatation, or in a cyst resulting from rupture of the vein and extravasation of the blood into the surrounding cellular texture; the tumour becomes solid, harder and proportionately incompressible; its colour also is less clearly blue, as the vein, cellular texture and skin, become thickened. The fold of skin, which contained the dilated vein, remains, as the vein subsides; and the tumour then presented is a loose, pendulous bit of anal integu-

ment. This result is simulated from time to time during the active state of an external pile; the tumour being loose and flaccid when empty in the interval of an attack, and again tense whenever congestion supervenes. In this state,—that of congestion, external piles are occasionally liable to *inflammation*, accompanied with increased enlargement of the hæmorrhoid, forming an oval tumour, tense, red, and acutely tender. Suppuration may ensue, converting the pile into an abscess; this bursting, the clot of blood escapes with the pus, and when the abscess closes, the venous dilatation usually becomes obliterated; thus reducing the pile to a small flap of integument. A fistulous opening sometimes remains, which might be mistaken for the orifice of a blind external fistula. Examination with a probe, as to its depth, will at once show the difference.

*Internal* Hæmorrhoids undergo a parallel series of structural changes. The lower or smaller veins of the plexus, and ultimately the larger veins higher up, are dilated irregularly or into pouches, filled with dark coagula, often compact and hard. A bunch of varicose veins, crowded in the lower ends of the longitudinal folds of the rectal mucous membrane, presents prominent projections of this membrane; thus deepening the pouches there existing, between the folds. A number of smaller dilated veins also, sometimes form in the short columnar processes which are situated in the spaces between the folds. Two or three of the larger prominences of the longitudinal folds meeting below, coalesce; forming a transverse fold just within the sphincter. The arteries, which are abundantly supplied to the lower part of the rectum, and have a longitudinal course towards the orifice where they freely communicate, also enlarge considerably. In old-standing hæmorrhoids, the mucous membrane and sub-mucous cellular tissue become greatly hypertrophied, and extremely vascular. Elongated processes of a polypoid form are thus produced; extending to an inch in length; and projecting transverse folds, an inch or more in width.

The *symptoms* contrast in two important particulars with external piles. At first, internal piles present no external appearance at the anus, but they not unfrequently bleed. Hence, the distinction commonly made of Piles into *open* and *blind*, as they bleed or not. The first symptom of internal piles, is generally, an attack of hæmorrhage, venous or arterial, and more or less profuse; merely tinging a motion, or escaping as a few drops of blood afterwards, or to the amount of several ounces. Accumulating within the bowel sometimes, the actual loss of blood from the system may be greater than appears at first sight. This discharge of blood is attended with, or preceded by, a bearing-down weight in the fundament, and more or less frequent desire to micturate. Straining efforts are made to evacuate the contents of the bowel, the passage of fæces being both difficult and painful; at length, hæmorrhoidal tumours, with mucous membrane, are protruded, or prolapsed to some extent at the anus, in the act of defæcation, accompanied with mucous discharge. They then exhibit remarkable diversities of appearance; according to their number, size, and condition. Commonly, there are three distinct prominent growths differing in size; one at each side of the anus, and a third in front, this, the perineal, being usually the largest. In old-standing cases, there may be four or five such projections. Their boundaries are generally well marked; or the piles merge into each other, forming a nearly circular protrusion. A single pile of large size, is sometimes the only protrusion, situated towards the front of the anus adjoining the perineum.



Consisting of bright red mucous membrane connected with a loose fold of integument, it often forms in young persons, especially women.

*Extruded Piles* present a variable appearance also, depending on their condition, as being *congested*, or *constricted* by the sphincter. In an inactive state, and in a relaxed state of the sphincter,—they form softish tumours of a red granular appearance, protruding just at the orifice of the anus; when fully protruded, tightly constricted and congested,—they are large, tense swellings of a deep red colour, and smooth surface, which readily bleeds. *Ulceration* occurs, occasionally; attacking the tumour in many points at once, but advancing seldom to any great extent. Bushe saw an instance of phagedænic ulceration; and in two cases, hæmorrhage of a florid character, supervened. *Mortification* and *sloughing* of the hæmorrhoids may result from complete strangulation by the sphincter; a process of natural cure which sometimes occurs, and, although attended with much suffering, it is free from any danger of hæmorrhage. Dr. Bushe mentions having seen a fatal result in one case out of four which he had met with.

When the hæmorrhoids are of large size, and fully protruded, the integument at the margin of the anus becomes everted, and forms a broad band girding the base of the tumours externally. The skin, thus everted, swollen, irregular, and of a livid colour, is liable to be mistaken for external piles; but its excision in an operation would probably be followed by serious contraction of the anus. External and internal piles often do co-exist; but then the sphincter, covered by integument, usually forms a narrow band separating the two. When, as sometimes follows, the two forms merge into each other, their difference may be recognised by the character of the integument,—skin or mucous membrane, at the line of junction; though I have seen this difference disappear in oft-protruded piles, as the mucous membrane by frequent exposure acquired the character of skin.

*Inflammation* of internal piles is apt to occur, under the irritation of a costive motion, a brisk cathartic, a slight excess of wine, or irregularity of diet; producing what is called an "attack of piles." Their inflammatory swelling is attended with a sensation of heat, weight, and fulness, just within the rectum; difficulty and pain in passing a motion, and distressing irritability of the bladder. Pain of a dull aching character, may be felt in the loins and down the thighs, leading to the supposition in females that the womb is affected. Febrile constitutional disturbance is often severe. Then protrusion takes place at the anus, in the act of seeking relief by stool, or in straining to empty the bladder; the extruded hæmorrhoids become constricted by the sphincter, and the congestion resulting from strangulation of the acutely sensitive inflamed piles, entails yet further suffering.

*Hæmorrhage* is liable to occur, before or after protrusion, and may bring speedy but temporary relief, the piles subsiding; and this natural blood-letting has been regarded as a salutary vent or safeguard in persons having an apoplectic tendency, or disposed to other visceral congestions. But the quantity of blood lost through internal hæmorrhoids varies considerably, from two or three tablespoonfuls, to several ounces or pints; and thus the patient's general health may be seriously reduced by oft-recurring attacks, aided by the almost incessant muco-purulent discharge, and the suffering incident to this hæmorrhoidal affection.

The hæmorrhoidal flux, or discharge of blood from internal piles, depends on a determination of blood to the rectum; whereby also the piles

progressively increase in size or grow, as often as it recurs. This afflux of blood and discharge may be periodical, occurring monthly, or at intervals of two, three, or six months; and it may be remittent or intermittent. It continues usually from three to six days, increasing in quantity up to the third or fourth day, and then lessening. Women usually suffer more from piles at the catamenial period; and the flux occurs chiefly at the time of the menstrual flow, or it may be compensatory for a deficient discharge from the uterus.

*Complications.*—Piles are frequently associated with other diseases of, or affecting, the rectum; such as prolapsus, fistula, or fissure; they are also connected with diseases of the urinary organs, as enlargement of the prostate, stone in the bladder, and stricture of the urethra; and with diseases of the uterus. In relation to both the latter classes of diseases, as pertaining to the bladder and uterus; hæmorrhoids are the result of the vascular communication of these organs with the rectum, principally through the hæmorrhoidal veins. This connexion is most direct between the prostate and rectum; and the straining efforts to relieve the bladder in diseases of this gland, or with stone or stricture, will necessarily dilate and engorge the hæmorrhoidal veins. In thus enumerating the more important complications of hæmorrhoidal affections, I exclude causative conditions of disease, as of the liver or other organs, in their relation to portal congestion.

*Diagnosis.*—Internal Piles must be distinguished from prolapsus of the rectum, occurring alone, from polypi of the bowel, and from condylomata about the anus. *Prolapsus* in the form of a rugous flap of mucous membrane, on either side of the anus, is most liable to be mistaken for protruded piles. But the semilunar form of these flaps, the extent of their base, the gliding feeling of the folded membrane between the thumb and finger, and the absence of erection and hæmorrhage; are all diagnostic signs. In *polypus*, its pedunculated character, large size, incapability of erection or collapse, pale red colour, and slight disposition to bleed, are sufficiently distinctive of every species of this growth. Moreover, mucous polypus has a very soft spongy feel; and fibrous polypus, a solid and firm consistence. *Condylomata* are readily distinguished from piles, by their flat shaped, soft and mucous character, or their warty appearance; and their occurrence in other parts, as the scrotum or vulva.

*Causes.*—All the causes of hæmorrhoidal affections operate by producing congestion of the hæmorrhoidal veins, chiefly by obstructing or retarding the portal circulation, and thence the return of blood from the rectum; or by inducing a determination of blood to that part. The *structure* of the hæmorrhoidal veins, as being unprovided with valves to break the weight of the column of blood, the large size and tortuous course of these vessels, and the formation of a close plexus of intercommunicating veins; constitute an hydraulic arrangement which predisposes to a slow circulation of the blood around the lower part of the rectum. So also the thin and yielding character of the mucous membrane overlaying the veins, and of the anal cutaneous integument below, constitutes a structural condition favourable to the production of piles, internal and external. The ordinarily dependent position of the rectum has a co-operative tendency. *Predisposing* causes are; age,—adult life, or middle age; sex—males rather than females are liable in adult life; but conversely, after cessation of the catamenial discharge, in later life; sedentary habits; climate—warm and moist, or changeable; period of the year—spring and autumn; hereditary predisposition; plethora, and the sup-

pression of other hæmorrhages; passions, whether violent or depressing; tight lacing, or the application of bandages to the lower limbs; sitting on stuffed or on pierced seats; and, as specially affecting the portal circulation;—habitual constipation, disease of the liver or heart, pregnancy, or the development of other tumours in the abdomen or pelvis, and the straining efforts at micturition, with disease of the prostate, stone in the bladder, or stricture of the urethra; and the habitual excess of venery. *Exciting* causes are principally of an irritant character, as affecting the intestinal canal and inducing a determination of blood to the rectum; stimulating purgatives, or enemata, excess of wine, spiced or other stimulating food, a costive motion, ascariides, diarrhœa; or external irritation, as hard riding on horseback.

*Terminations.*—The various terminations of hæmorrhoidal affections have already been alluded to in describing the external and internal forms of piles. Their issues may be thus enumerated; subsidence; or obliteration,—by coagulation, suppuration, ulceration, sloughing.

*Treatment.*—Remedial, as well as preventive, measures must have reference to the various causes of hæmorrhoids; and the removal of such causes will be suggested in many cases by their nature, whether predisposing or exciting in their action.

*Constitutional* treatment is both medicinal and hygienic. To relieve portal congestion; the bowels must be carefully regulated by mild aperients which shall influence the whole intestinal canal and promote the secretion of bile, and by attention to diet, with daily walking exercise,—excepting during an attack of piles when the patient will be sure to seek the recumbent posture. The state of the general circulation should, at the same time, be regarded; in plethoric persons, a depletory course of aperients and reduced diet being indicated; in weak, anæmic persons, a tonic and unirritating dietetic plan of treatment. Thus may be advantageously combined aperients and tonics. A daily dinner pill is a convenient mode of administration; consisting of the watery extract of aloes, compound rhubarb pill, and blue pill, with nux vomica. The watery extract dissolves more readily, and acts before reaching the rectum. Other forms to be recommended are in particular, a lenitive electuary; consisting of bitartrate of potash and precipitated sulphur, in equal parts, with perhaps a little confection of senna, and sufficient honey or treacle to form an electuary. A teaspoonful may be taken every night at bed-time. This I have been in the habit of ordering, for many years since, in hæmorrhoidal affections, and have almost invariably found it of great service. Taraxacum in large doses,—ten or fifteen grains, and Plummer's pill, are both efficacious agents for relieving the portal circulation through the secretion of bile; and the mineral acids, especially the nitro-muriatic, seem to have some influence in that way; while, as tonics they support the general circulation. The confection of black pepper, Ward's paste, has long been in great repute as a remedy for piles; a drachm dose being taken three times a day. It is supposed to act directly on the piles as a stimulant application, and might therefore be more advantageously introduced at once into the rectum. This was done by a patient of Sir Edward Home, as related by Sir B. Brodie, and it had the effect of curing him. Cubebs is also taken internally with the same view. I concur with Mr. Curling in not much recommending these remedies; and my experience is that such stimulants are more beneficial in promoting the healing of a sluggish wound after the operation for fistula or fissure in ano.



*Local* applications are important adjuncts to the constitutional treatment, and as a means of allaying pain. *External* piles may be sponged with cold water, or with some sedative and astringent wash, as weak lead lotion, or a weak solution of alum, sulphate of zinc, sulphate of iron, or of the muriated tincture. The unguentum gallæ is also beneficial. *Internal* piles are amenable to similar applications used internally as injections or lavements. Cold water alone, thrown into the rectum every morning, often proves very efficacious in constringing the dilated vessels and softening the motion which follows its use. Medicated astringent injections, as of iron or alum with decoction of oak bark, should be thrown into the bowel at bed-time, that during the night any such application may have time to act on the piles. But they should be weak solutions, as a grain of sulphate of iron to an ounce of water; and used in small quantity, only two or three ounces at a time. Citrine ointment is said to be very beneficial, when the hæmorrhoids are in an unhealthy state accompanied with a slimy discharge; a little of the ointment being inserted within the sphincter every night, by means of the finger, which the patient can himself accomplish. An ointment of nitrate of silver is also very useful, although liable to stain the linen.

When piles become *inflamed*, the patient must keep the recumbent position, and cold or warm applications will be appropriate. Pounded ice is highly recommended by Mr. Curling, who finds that it generally gives complete relief in a few hours. Warm fomentations or poulticing may be preferable, and if several piles be affected, a few leeches should be applied around the tumours. An external pile may be opened with a lancet, and the coagulum squeezed out; an abscess should be punctured and poulticed. Internal piles having *protruded*, they must be returned by gentle uniform pressure, to empty the piles of blood, and then to push them back within the sphincter. If tightly strangulated, they may be punctured in several places with a needle, and cold or iced water applied; and then with a little manipulation they will probably slip up. Prolonged strangulation and a tendency to sloughing, forbid any attempt at reduction; warm fomentations should be used.

*Operative Procedures.*—When piles are beyond the control of medical treatment, general and topical, or hæmorrhage from them is detrimental to health, operative interference becomes necessary. No such interference should be resorted to if the piles be in a state of active inflammation, excepting perhaps when they are quite external. Piles may be removed by excision, ligature, or cauterization. The first method is applicable exclusively to external hæmorrhoids; the latter two are appropriate for the removal of internal hæmorrhoids.

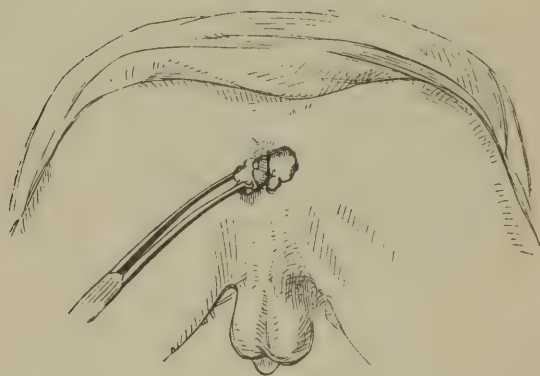
*Excision* is a simple operation, easily performed, and very effectual. The patient lying on his side with the knees well drawn up, and the buttocks held apart; the tumours are seized with a vulsellum or hooked forceps, and successively snipped off with scissors curved on the flat, and applied flatwise at the base of the tumour. Any loose, redundant portion of skin may be included in the excision, but all such integument should not be removed, lest the contraction of cicatrization might leave the patient with a strictured anus. Hæmorrhage is easily controlled by cold and the pressure of a pad, secured by a T bandage. A small spouting arterial vessel may be twisted. After the removal of an *inflamed* external pile, the bleeding relieves the symptoms, and then the part heals rapidly. This would be a most painful operation in the case of inflammation, unless

performed under the influence of chloroform; or of local anæsthetic agents, which are equally effectual, as ice and salt, or the ether-spray.

*Ligature.*—Internal piles should be removed only by ligature. It is the safest procedure—owing to the liability of hæmorrhage, and the most permanently curative,—in preventing the recurrence of hæmorrhoids with the accompanying prolapsus of the rectal mucous membrane. The operation is, however, not so free from the slightest risk, as Mr. Syme has represented. Erysipelatous inflammation may creep up the bowel; pyæmia and tetanus are also occasional consequences. The conditions of internal hæmorrhoids most fitted for this method of removal, are; where the tumours consist chiefly of large, prominent, globular or pedunculated, venous dilatations, having a dark-blue appearance; or where the tumours having a bright red colour, readily bleed, but the prolapsed mucous membrane is thickened or abundant. A marked tendency to uncontrollable hæmorrhage, in any case, will always render the operation requisite.

The bowels having been relieved by castor-oil or other mild aperient, an enema of warm water should be given shortly before the operation, in order that with its evacuation the piles may descend well into view. This effect may be aided by desiring the patient to sit over a pan of warm water, and bear down. Then, lying on the side most convenient to the operator, with his knees drawn up and the buttocks separated by an assistant; one of the tripartite portions of the protrusion is seized with a vulsellum (Fig. 427), double four-pronged forceps, or with the loop-

FIG. 427.



eyed forceps, and drawn downwards, inclining inwards so as to fairly expose the junction of the anal integument and mucous membrane. At this point, a deep notch or incision is made with a long, straight pair of scissors; applied just on the mucous-membrane side of the junction, as being far less sensitive, and taking care to cut along the inner side of the rectum and not into the pile. The depth of incision must be such as to reach the base of the pile; and if it be pedunculated, long arterial vessels will probably be seen coursing down to the stalk of the pile. The requisite depth is ascertained by the Surgeon moving about the portion of protrusion with the vulsellum, as he clips deeply with the scissors. Handing the former instrument to an assistant, a ligature of fine whipcord is

passed well into the notch, and carried round the root of the pile, and knotted so as to securely strangle it. Sometimes, the base of the protruded portion is too broad to be thus strangulated; then it must be transfixed, by passing a deeply-curved *nævus* needle armed with the ligature, through the base, and each half tied separately. Other portions of protrusion are ligatured in the same way. It is, however, unnecessary to include every portion of the thickened and prolapsed mucous membrane. An open surface is left of sufficient extent to prevent any redescend, as contraction ensues; further removal might induce a strictured condition of the rectum. Any external pile or redundant portion of anal integument, may be excised, observing the same precaution as to the extent of such removal. The ends of the ligatures are cut off close to the piles, or left long if hæmorrhage be likely to occur. In either case, the protrusion had better be returned into the rectum, otherwise the pain occasioned subsequently by the constriction of the sphincter will be more than that of the operation. If hæmorrhage occur, the ligature-ends, hanging out of the anus, will enable the Surgeon to draw the parts out again and secure any bleeding vessel. Chloroform is scarcely requisite in the operation as thus performed,—by cutting through the mucous membrane. The *after*-treatment is very simple; a full dose of opium the first night to prevent pain and any action of the bowels, and the liability to irritation about the neck of the bladder with spasmodic retention of urine. Hyoseyamus and camphor mixture will then also prove efficacious. A dose of castor-oil may be given on the third or fourth day; and one or two of the ligatures sometimes come away with the evacuation. The whole are passed in about a week; but still the patient should keep his bed for some days longer to insure the closure and contraction of the mucous surface, before the upright posture is resumed.

*Cauterization*.—This method of treatment is intended as a substitute for the ligature of internal piles, in certain forms of these hæmorrhoids. When the tumour is flat and sessile, of a bright red colour, and easily bleeds, its substance consisting more of small arteries than of dilated veins; a ligature is less readily applied to the base of such a shaped tumour, and cauterization with strong nitric acid is equally effectual in destroying the pile. So also if its mucous covering be granular or ulcerated; or without any decided hæmorrhoidal tumour, if the rectal mucous membrane be congested and relaxed, with a tendency to bleed; nitric acid proves very beneficial, especially in the latter condition.

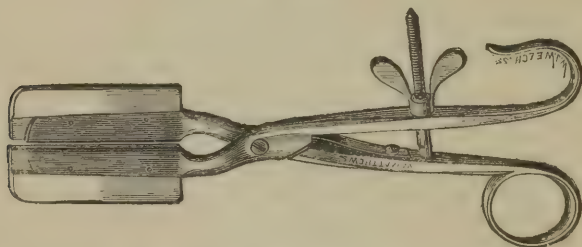
Cauterization—by means of strong nitric acid, was originally recommended by Dr. Houston of Dublin, followed by Sir W. Fergusson; but in England, this method of treatment has been particularly advocated by Mr. H. Smith, and Mr. H. Lee. The acid is very easily applied. Protrusion of the pile may be caused as for the operation of ligature; or the application made through an anal speculum,—a tube open on one side, by which the diseased surface can be reached. A glass rod or brush dipped in the acid is rubbed freely over the surface, and the part dabbed with a piece of lint saturated with prepared chalk and water; the protrusion is then returned into the rectum, or the tube withdrawn. The only precaution should be to avoid touching the surrounding anal integument, for which purpose it may be well smeared with oil or grease, before applying the acid. Relief soon follows a single application in some cases, and it is unnecessary to confine the patient to bed; so that this might be termed the ready method of treatment as compared with ligature. But



its permanently curative efficacy may be doubtful. Cure seems to take place by coagulation of the blood within the pile, obliterating it, then the formation of an ulcerated surface by sloughing, which being succeeded by cicatrization and contraction, may gradually *brace* up the relaxed mucous membrane. It may, however, result in over-contraction; there is also some risk of erysipelatous inflammation as a consequence of cauterization, although not more probably than after ligature.

The *clamp* procedure is a combination of the treatment by ligature, and by nitric acid. The advantages of this method are; the avoidance of any danger consequent on ligature, and the shorter duration of treatment,—about two or three days. But the disadvantages seem to preponderate; it will probably be a less effectual operation, and there is the risk of hæmorrhage. The tumour is seized and compressed, with the clamp for a period of a few minutes; its free surface is then excised by a pair

FIG. 428.



of scissors, and the surface, thus exposed, is touched with the strongest nitric acid or with the actual cautery. The clamp is removed, and the parts being well oiled, the operation is completed. This method, practised for some years by the Dublin Surgeons, has been chiefly advocated by Lee and H. Smith; the latter Surgeon having devised an "improved clamp," worked by a screw (Fig. 428), so that pressure may be gradually taken off, and any bleeding vessel can be readily seen and secured.

The *écraseur* has been used for the removal of internal piles; a practice in vogue with some French Surgeons, especially Chassaignac; but which has not yet found much favour with Surgeons in this country. Although a painful proceeding, the freedom from hæmorrhage might recommend it; but the probable occurrence of stricture of the rectum after cicatrization, is a very grave objection to this mode of operation.

**PROLAPSUS OF THE RECTUM.**—*Structural Conditions.*—In connexion with internal hæmorrhoids, prolapsus of the rectum is an almost necessary accompaniment. The latter may, however, occur alone, and this protrusion through the anal orifice is sometimes called *prolapsus ani*; an incorrect designation, seeing that the anus as merely the terminal aperture of the rectum, cannot itself be protruded.

Prolapsus recti may happen in two forms. Usually, the *mucous coat* alone descends, owing to its loose connexion with the muscular coat; and the prolapsus then consists of an everted duplicature of mucous membrane. Occasionally, the *muscular coat* also descends with this membrane, constituting an everted duplicature of the whole thickness of the bowel. The possibility of this complete prolapsus of the rectum was formerly doubted by Copeland and other authorities, but the question is now set at rest by the existence of such a specimen in the Museum of King's College.

*Signs.*—The signs or appearances of prolapsus recti are very obvious; the protruded part has the ordinary vascular-red colour of mucous membrane, and is wet with mucus; the surface may be thrown into transverse rings or folds around the protrusion. Its shape varies, and apparently according to the extent of the part. Commencing usually in the form of one or two lateral folds of mucous membrane on either side of the anus, the protrusion soon becomes an unbroken ring, encircling the anus; as it enlarges, it may acquire a cylindrical shape, tapering somewhat towards its free end, and there present an orifice at the reflection of the membrane upwards, which leads into the bowel. This is now the anal orifice of the rectum. The extent of protrusion varies considerably; in children, reaching perhaps to six or eight inches; in adults being more limited, and having more of a globular than a cylindrical form. In old persons, the prolapsus frequently attains a large size, owing to the laxity of the sphincter. At either extreme of life,—infancy or old age, complete prolapsus of the rectum—involving the whole thickness of the gut, is more liable to occur.

The two forms of prolapsus may be readily distinguished; in the descent of mucous membrane alone, the protruded portion is continuous with that investing the sphincter; whereas, with invagination of the whole thickness of the gut, there will be a distinct and deep sulcus between the protrusion and the margin of the sphincter.

In *old-standing* prolapsus, the mucous membrane becomes thickened and leathery, involving the sub-mucous cellular tissue; the sphincter is much relaxed and the anal orifice as much enlarged, while the surrounding integument is thickened, redundant, and pendulous; facilitating the occurrence of prolapsus.

Sympathetic affections of other organs often accompany the depressing sense of bearing-down occasioned by the prolapsus. Irritability of the urinary bladder, or spasmodic retention of urine are frequently experienced, and much flatulent, dyspeptic irritation. Pain extends across the loins and down the thighs. These symptoms are aggravated, when the protrusion is recent and nipped by the sphincter, but the bowel may then recede spontaneously; a more chronic state of loose prolapsus, oft recurring and oft returned, is productive of perpetual suffering.

Congestion, ulceration and purulent discharge, are apt to occur; strangulation and sloughing have also been known to take place, and a natural cure may thus be effected.

The *causes* of prolapsus are predisposing, or exciting, in their operation. *Predisposing* conditions may be fairly expressed by the terms general debility with an atonic state of the intestinal canal. Thus, prolapsus of the rectum is met with most frequently in weakly children or adults, and who are the subjects of atonic, flatulent, dyspeptic symptoms. The *exciting* causes of this affection vary with the period of life; in childhood, ascarides or some other source of intestinal irritation, giving rise to diarrhoea, frequently results in prolapsus; in adults, constipation, and especially accumulation of faeces in the rectum, is the more common cause, aided by the straining efforts in defecation. The bowel comes down with each evacuation, and progressively enlarges. Other causes operate in a similar manner; stone in the bladder, exciting frequent and difficult micturition, is a cause of prolapsus at either extreme period of life; stricture of the urethra, and enlargement of the prostate, as life advances; and the latter especially in old age. The habitual use of

copious lavements has undoubtedly a prolapsing tendency. Internal hæmorrhoids result in prolapsus, by dragging down the overlying mucous membrane with them in their descent.

*Treatment.*—Having regard to the causes of prolapsus, its remedial treatment should be both constitutional and local, the latter including operative measures.

The *bowel* must, of course, be first attended to, when in a state of protrusion. Reduction is accomplished, in the recumbent position; by gentle and uniform compression of the protruded portion with both hands, using a soft towel to protect the mucous surface, and to prevent its slipping from under the fingers. There may be some difficulty in returning the bowel, when the protrusion is large or the sphincter tight. Chloroform may prove effectual for overcoming the resistance; or by introducing the finger into the bowel, it may pass up with the finger and not re-descend when it is withdrawn; but, in extreme cases, it may be necessary to partially divide the sphincter by inserting a straight narrow bistoury or tenotomy-knife between the bowel and the anal orifice. When the bowel is fairly returned, a pad of lint or piece of sponge must be applied over the anus, and retained *in situ* by a T bandage. A well-fitting rectal supporter or truss should be worn in old-standing, established prolapsus.

The *constitutional* treatment will vary with the cause of prolapsus. A tonic plan of treatment is always appropriate, but the state of the bowels must always be specially regarded. In *children*, and especially the ill-fed children of the poor; it will generally be requisite to correct an irregular action of the bowels or diarrhœa, as depending on improper diet, often an excess of vegetable food. The removal of this cause of intestinal irritation must be coupled with the administration of tonic purgatives, and the rectification of the intestinal secretions. Perhaps, the most generally useful form of combination, is rhubarb, hydrargyrum cum cretâ, and carbonate of soda or magnesia; taken as a powder every night at bed-time. Ascarides may be the source of irritation in some cases, or the diarrhœa may be sympathetic as depending on dentition. In *adults*, the habitual constipation usually present must be overcome by castor-oil, lenitive electuary, or bitartrate of potash; or by mild enemata, if the constipation be rectal. Stone in the bladder, enlarged prostate, or stricture of the urethra, will obviously require attention, when prolapsus depends on these causes.

*Local* treatment, of a medicinal character, consists chiefly in the use of astringent injections, to correct the relaxed state of the mucous membrane. For this purpose, the decoction of oak bark, with alum, in the proportion of a scruple of the latter to eight ounces of the decoction, will be sufficiently astringent; and a third of the quantity enough for an injection. The muriated tincture of iron, a drachm to a pint of water, is also an excellent astringent; two or three ounces being thrown up, or more according to the age of the patient. Mr. Curling usually prescribes the one formula, Sir B. Brodie preferred the other. Infusion of rhatany or a solution of tannic acid, may also be employed with advantage. Any injection should be used cold, and allowed to remain in the rectum for some time, which is more conveniently done at bed-time. A *diseased* state of the prolapsed mucous membrane must be managed on ordinary principles. Thus, an ulcerated surface may be brushed with a solution of nitrate of silver.

*Operative* procedures are resorted to for the cure of inveterate prolapsus.



They are excision, ligature, and cauterization. The object is to produce such an amount of contraction, by the healing of a wounded surface, or after slight sloughing of the mucous membrane, as shall effectually and permanently brace up the previously prolapsed part.

*Excision*, as first proposed by the late Mr. Hey of Leeds, consisted in removing only the loose and pendulous flaps of skin around the anus; but Dupuytren's modification consists in removing also portions of the mucous membrane. This procedure is certainly requisite, when the prolapsus is large, and the membrane thickened. The patient lying on his back and the legs trussed up as for lithotomy; a fold of skin and mucous membrane, at the side of the anus, and more or less broad according to the laxity of the part, is seized with a vulsellum, drawn a little forward, and excised with a curved pair of scissors. This is repeated on the other side, thus forming two oval wounds, longitudinally; and sometimes further portions may require removal. Any bleeding arterial vessel should be twisted or tied; lest hæmorrhage occurring after the operation, bleeding may take place into the bowel and escape observation.

*Ligature* was originally proposed by Mr. Copeland. It is especially adapted for a condition of voluminous and lax mucous membrane—associated perhaps with internal hæmorrhoids—but unaccompanied with any or much participation of the anal integument. The operation is easily performed, by seizing with a vulsellum selected portions of the mucous membrane, and casting a whipcord ligature around each; cutting off the ends of thread, and returning the whole within the sphincter.

*Cauterization* is usually effected by means of strong nitric acid, and this method of treatment was much advocated by Sir B. Brodie. It has since been employed in many cases; Mr. Ashton has applied the concentrated acid with the "happiest result," and Mr. H. Smith has found it act like "a charm." There can be no doubt about the truth of these representations, qualified as they are by specification of the appropriate conditions of prolapsus. Nitric acid is suitable in the same condition as that fitted for ligature; but it is specially applicable when the mucous membrane is extremely vascular,—of an arterial character rather than venous, presenting a velvety appearance; or again when the surface has an unhealthy, ulcerated appearance. The acid is applied by means of a glass brush; care being taken to protect the surrounding parts with thick oil or grease, and to dab away any excess of acid from the diseased surface.

Chloroform may be administered in any of these operations, not so much for its anæsthetic influence, as to relax the incessant action of the sphincter.

**POLYPUS OF THE RECTUM.**—Any growth springing from the mucous membrane of the rectum, and attached by a narrow and elongated pedicle, is named a *polypus* of the rectum. The tumour, thus characterized by its stalked shape, differs in structure from simple hypertrophy of the mucous membrane, which is also occasionally pedunculated.

Polypus-growth varies in *structure* and *appearance*, forming different species, which have been variously named by authors on this subject. They may be described as;—(1) the *vascular* polypus; (2) the *villous*, an extremely vascular growth; (3) the *lobulated*, also vascular, and semi-malignant; (4) the *fibro-cellular* or *mucous* polypus; and (5) the *fibrous* polypus. The first four species are soft in consistence, and the vascular forms are prone to bleed; the fifth is hard, and comparatively bloodless.

In point of situation, any form of polypus springs from the mucous membrane within the sphincter ; but generally at the lower part of the rectum, ranging from about an inch to three inches from the anus. The size varies in different species; the ordinary vascular polypus being about the size of a pea or a cherry, the villous species attaining to that of an orange. This form of polypus has been specially described by Mr. Quain. Polypus-growth is usually single, but more than one or several may form. The period of life varies, and principally in relation to the species of growth. Vascular polypus is the form commonly met with in children; other species occur chiefly in adults,—a villous polypus in the rectum of a man, aged seventy, was not detected until about five years previously. The specimen is preserved in the Museum of St. George's Hospital. Generally speaking, polypus of the rectum occurs most frequently in children, according to Sir A. Cooper's experience; in adults, according to the observations of Bushe and Syme.

*Symptoms.*—The general symptoms of rectal polypus are those referable to the presence of a foreign body in the rectum. A sense of weight and fulness, with tenesmus and mucous discharge; is followed by protrusion of the growth when an evacuation occurs, and spasmodic contraction of the sphincter, if the tumour be situated in the anus or is attached by a long stalk higher up. As a growing polypus enlarges, diarrhœa, flatulent distension of the bowels, irritability of the bladder, and other sympathetic affections supervene. Obstruction of the bowel produces variously contorted or figured fœces, and sometimes leads to almost complete retention of the fœces, with intestinal distension. This result happened in the case of the villous growth just alluded to.

In addition to these symptoms of mechanical origin; hæmorrhage recurring from time to time, is characteristic of the vascular forms of polypus, as distinguished from those which bleed less readily. Malignant vascular polypus is attended, moreover, with certain peculiar symptoms; pain, lancinating and extending up the sacrum and down the thighs, amounting to scalding agony when a motion passes; copious bloody, fetid purulent discharge, as ulceration supervenes; and the sallow cachectic emaciation of advanced cancerous disease.

Examination of the polypus-growth will determine the particular species; and this can be accomplished, either by injection of warm water, causing the tumour to protrude with the evacuation, or by examination *in situ* with the anal speculum.

*Treatment.*—Removal of the growth offers the only prospect of cure. Ligature is preferable to excision, particularly as regards the vascular forms of polypus. Sir A. Cooper and Mr. Syme concur in the advisability of this method of removal. The bowels having been acted on as far as possible, to prevent the necessity of any relief for some days after operation; the tumour is made to protrude as for examination, when it must be seized with a vulsellum and drawn down, until its peduncle is fairly seen; a ligature is then applied around its origin, and the stalk cut off beyond by a pair of scissors, observing not to cut too closely lest the ligature should afterwards slip off. A broad-stalked polypus had better be transfixed at its base, by a needle carrying a double ligature; each portion is then tied. When situated high up the bowel, and out of reach with the fingers; the ligature must be passed by means of a double canula, or through a gum-elastic catheter, as in ligaturing polypus of the uterus.

STRICTURE OF THE RECTUM.—*Structural Conditions.*—The rectum, like

other mucous canals, is subject to contraction or narrowing of its calibre. This state may result from either of two conditions,—simple *fibrous* thickening, or *cancerous* thickening, of the coats of the bowel. These two conditions of stricture differ widely in their nature, symptoms and treatment.

(1) *Fibrous Stricture*.—This condition of stricture presents a prominent ring within the cavity of the rectum, entirely or partially surrounding the cavity of the bowel. It consists apparently of a fold of thickened mucous membrane, but principally of fibrous condensation of the sub-mucous cellular tissue; occasionally, there is co-existing hypertrophy of the muscular coat, rarely any change in the peritoneal investment which generally retains its healthy structure. The structural alteration is sometimes limited in extent, presenting an *annular* stricture; more frequently, the induration extends from half an inch to two or more in length, reaching to three or four inches, or even nearly the entire length of the rectum. If the thickening is greater on one side of the bowel than the other, the passage assumes an irregular winding shape. In rare cases, the contraction of the canal seems due to muscular action, no structural change having been discovered in the coats of the rectum; and also rarely, it is owing to the formation of fibrous bands across the cavity of the bowel, the wall of the gut remaining unaffected. Specimens of both these conditions of stricture exist, the one in the Museum of St. Bartholomew's Hospital, the other in King's College Museum. The *situation* of fibrous stricture is commonly at the lower part of the rectum, from an inch and a half to two inches from the anus, and easily within reach of the finger; next in order of frequency, at two to three inches distant from the anus; occasionally at four or five inches; and sometimes at the junction of the bowel with the sigmoid flexure of the colon. Very rarely, two distinct strictures have been met with; two such cases were seen by Mr. Curling, one of which originated in dysentery. *Above* the seat of stricture, the rectum is usually dilated, and thickened just above the part diseased. This thickening is owing to hypertrophy of the muscular coat, in consequence of the increased functional action of the bowel at this point to overcome the obstruction. The mucous membrane, above the stricture, is rarely healthy; being either unduly vascular, or ulcerated and pus-discharging. Ulcerated apertures may at length lead downwards along fistulous passages which open externally near the anus, or in the front of the perineum, or posteriorly as far off as the buttock. Sometimes, a fistulous communication forms between the rectum and the vagina or the urethra; and occasionally between the bowel and the cavity of the peritoneum. *Below* the stricture, the coats of the bowel are less changed; but there is frequently diffuse ulceration of the mucous membrane, perhaps hæmorrhoids, or a complete fistula in ano.

*Symptoms*.—Stricture of the rectum commences insidiously. The earliest symptom is that of some mechanical obstruction to the passage of the feces in the act of defæcation. Hence, frequent constipation ensues, with straining efforts at stool. This difficulty may be readily overcome by a solvent purgative, and the nature of the case remain unsuspected. But the feces become more scanty, narrowed or figured, and often voided in small lumps. Fæcal and flatulent accumulations above the stricture give rise to abdominal distension; while an irregular, feculent and mucous diarrhœa occasionally relieves the otherwise habitual tendency to constipation. In the *ulcerative* condition; scalding pain, and bloody, slimy



mucous or purulent discharge, are superadded to the symptoms of obstruction. Examination per rectum will affirm or negative the presence of stricture. On introducing the fore-finger into the rectum, the stricture can generally be felt; when its nature,—whether fibrous or malignant, perhaps the degree of contraction, and its extent, may also be determined. If situated beyond reach of the finger, the introduction of an oiled wax or gum-elastic bougie may possibly enable the Surgeon to ascertain the presence of a stricture, but not its nature; also its height from the anus, the degree and extent of contraction,—by observing the relative length, the size and obstructed portion of the bougie. In using the instrument, all these particulars must be gained very cautiously;—the curve of the rectum from before backwards and its inclination to the left high up, being duly remembered; also the promontory of the sacrum against which the point of the bougie is apt to impinge, and the presence of the natural folds of mucous membrane which may intercept its progress. Unless these circumstances be observed,—as to the course and character of the canal, some degree of obstruction might convey the impression of stricture. Indiscriminate pressure might then rupture the mucous membrane and open the peritoneal cavity; the point of the instrument seeming to pass, really turns downwards into the rectum.

The *causes* of fibrous stricture relate to its pathological origin. It proceeds from chronic inflammation of the mucous membrane and sub-mucous cellular tissue; resulting in fibrous deposit, especially affecting the latter texture. Ulceration or abrasion of the mucous membrane, resulting in contraction, may also produce stricture. The *exciting* causes are necessarily various; any source of irritation, as the impaction or passage of hardened fæces, foreign bodies as fish-bones, &c.; or the straining efforts in forcible defæcation. Syphilis has undoubtedly been known to produce stricture of the rectum, either as a primary or secondary affection. In women, difficult parturition or the unskilful use of instruments for delivery, may induce inflammation. Of 28 cases of stricture of the rectum which came under Mr. Curling's observation, 20 were women; and in 9 of them, the stricture commenced after labour, some of which were distinctly attributed to an injury at the time. The greater liability of females to this disease, accords also with the experience of Mr. Copeland and of Dr. Bushe. An external injury to the part has occasionally been the cause, as a severe kick in the fundament.

*Treatment.*—The principle of treatment is mechanical *dilatation* of the stricture. Considerable judgment is requisite in carrying out this treatment. Besides attention to the natural course and character of the canal and the nature of the stricture; two additional rules should always be observed in using dilatation,—namely, never to make any forcible effort, and never to cause pain. The instrument used should always pass with ease. The bowels should be kept free by mild aperients, especially castor-oil.

When situated *low down*, dilatation may be effected with tolerable facility, by the introduction of a proper-sized gum-elastic bougie, or compressed sponge-tent. Either form of dilator must be allowed to remain in the stricture; the bougie for ten or fifteen minutes, the tent may remain for twelve or twenty-four hours. Dilatation must be renewed every two or three days, and with progressively increasing sized instruments. Tent-dilatation is, however, the most effectual, owing to the swelling character of the compressed sponge. A very tight annular or

almost membranous stricture may be advantageously notched with a protected bistoury,—my “concealed fistula-knife” being serviceable for this purpose. The posterior aspect of the canal is the safest for a slight incision, not to endanger the peritoneum. Dilatation can then be pursued by a bougie or tent. Various other dilating instruments have been devised, by Weiss, Bushe, Arnott, Sir C. Bell, Charrière of Paris, Nélaton, Bermond, Todd, Costallat, and Coxeter; all of them are ingenious, yet not so efficient as the bougie.

If the stricture be situated *high up*, the same treatment may be adopted, but with very great caution. A wax or a very flexible gum-elastic bougie should be used. Pain or spasm ensuing from the use of instruments, admit of relief by the occasional introduction of opiate suppositories. But however temporarily successful dilatation may prove, a permanent cure is seldom if ever effected. Dupuytren, Bushe, and Dr. Colles of Dublin, emphatically concur in the same opinion; Mr. Curling takes a more favourable view of this plan of treatment. Undoubtedly much will depend on having to deal with fibrous stricture in an early stage of its formation, and in prolonging the course of dilatation for some weeks or months after apparent cure.

*Palliative* treatment affords relief to the pain and discharge. Nitrate of silver, in the proportion of five grains to the ounce of distilled water, or the mild citrine ointment, may be applied with advantage to the diseased mucous membrane within the stricture, by means of a camel-hair brush passed through an anal speculum. Hæmorrhage may be restrained by cold alum or other styptic injections, administered through a long tube.

In extreme cases, of almost complete obstruction, Amussat's operation of colotomy must be resorted to.

(2) *Cancerous Stricture*.—The coats of the rectum are liable to the formation of every species of cancer—scirrhus, encephaloid, colloid, and epithelial; resulting severally in stricture of the bowel. Any such growth forming external to the rectum may so press upon and implicate the bowel, as to have the same effect. The disease is usually situated at the lower part of the rectum, within three inches from the anus; less frequently, at the junction of the sigmoid flexure of the colon; but any portion of the bowel may be affected.

*Symptoms*.—Commencing insidiously, the early or mechanical symptoms of obstruction are similar to those arising from fibrous stricture. But, the excruciating pain, its lancinating character, darting up the sacrum and extending down the limbs, the aggravated intensity of the pain, as of molten lead, when the fæces pass, and especially when ulceration has supervened; with the increased tendency to hæmorrhage, and copious, fetid purulent discharge;—these symptoms, are somewhat diagnostic of cancerous stricture. Subsequently, the peculiar cachectic appearance and emaciation are distinctive constitutional symptoms. Examination per rectum will probably determine the diagnosis. If the disease be situated as usual,—low down; on introducing the finger into the bowel, considerable thickening of the bowel and narrowing of the passage are felt; but the consistence of this diseased portion of the bowel differs widely;—the resistance being that of cartilaginous induration,—in scirrhus stricture, and resembling a soft cushion,—in encephaloid or other soft cancerous stricture. If the finger can be insinuated into the stricture, an irregular nodulated surface is felt, and which is more exten-

sive than usually in fibrous stricture. Sometimes, nodules,—hard or soft are found, round about the seat of stricture. On withdrawing the finger, it is covered with blood and pus. Fistulous communications form between the bowel and adjoining parts,—the vagina, bladder, or urethra, which also become implicated. The lymphatic glands in the neighbourhood of the rectum become enlarged, and secondary cancer may be developed in other internal parts,—the lumbar glands, peritoneum, or liver. Death results from fecal obstruction, or from these complications.

The liability to cancer of the rectum varies with the *period of life*, and *sex*. It occurs generally, in middle life, and women are said to be more subject than men. This latter predisposition seems doubtful. Of 21 cases, noted by Mr. Curling; 17 were males, and only 4 females. Again, of 11 cases, noted by Mr. Baker in the *Med.-Chir. Trans.*, vol. xlv., 8 were males, and only 3 females. Of 35 cases at St. Mark's Hospital, as recorded by Mr. Carter; 19 were men, and 16 women.

*Treatment.*—*Palliative* measures are alone practicable. They consist chiefly in a light nourishing diet and a tonic course of treatment; with regulation of the bowels and solution of the feces by castor-oil and other mild aperients, and opiates administered internally, and per anum by injection or suppository, to assuage pain. Chloroform applied locally to the anus by means of a piece of lint covered with oil silk, or inhaled as usual, has given marked ease, although not pushed to the extent of insensibility; and its anæsthetic influence may be resorted to daily, if necessary.

The introduction of any instruments is always hazardous. Bougies and tents must not be thought of; feculent accumulations above the strictures may sometimes be reduced by passing a long tube through the stricture, and then giving an injection of warm water. But this proceeding must be conducted with the utmost caution.

Excision of the cancerous mass was proposed and practised by Lisfranc; and afterwards by Dieffenbach with success in no less, it is said, than thirty patients, not one of whom died in consequence of the operation. Nevertheless that such a procedure is justifiable, may well be doubted. Colotomy, in the left loin, seems a far more Surgical resource, both as a means of relieving misery connected with the rectum and of prolonging life.

**RECTAL FISTULA.**—Fistulous communications are liable to form between the rectum and adjoining organs; the bladder, as Recto-vesical Fistula, in the male; and the vagina, as Recto-vaginal Fistula, in the female.

(1) *Recto-vesical Fistula* is not often met with. It may result from disease, forming an ulcerative communication between the rectum and bladder, as in cancer of the gut; or be of traumatic origin, as from a wound of the bowel in the operation of lithotomy.

*Signs.*—The escape and discharge of the contents of either organ,—of urine *per anum*, and of feculent matter and flatus *per urethram*, at once proclaims the nature of the lesion; while digital or ocular examination through a double-bladed anal speculum, will plainly detect the situation and size of the fistulous opening. When resulting from disease, the cancerous or simple nature of the fistula, can thus also be readily discovered. Constant irritation, excoriation, and offensive odour, accompany the discharge of urine and feculent matter; the patient leading a life of seclusion and misery.

*Treatment.*—The object is to close the fistulous opening; but the



Surgical procedure appropriate for this purpose, must depend on the cause and extent of the opening. *Cancerous* fistula is incurable; and all that can be done is to palliate the patient's suffering, by opiate and detergent injections, with constitutional support. *Traumatic* fistula, if recent, and of small size, may perhaps be induced to contract and close; by introducing a pencil of nitrate of silver occasionally, or by means of the actual cautery,—a red-hot wire, or platinum wire heated by the galvanic current, as devised by Mr. Marshall; an anal speculum being used to protect the bowel, and effect the cauterization exactly within the fistulous opening. An old, callous fistula, and of larger size, cannot be closed in this manner; it will be necessary to lay it open, and convert the rectal or anal into a perineal fistula, so that it may granulate and heal from the bottom. This is accomplished by passing a grooved staff through the urethra, and cutting down upon it; dividing the sphincter and intervening portion of bowel. A strip of lint is then placed in the wound.

(2) *Recto-vaginal Fistula* is usually of traumatic origin; the result of sloughing of the posterior wall of the vagina, from long-continued impaction of the head or the use of instruments during parturition. The size of the opening varies considerably, from that of a small perforation to a large portion of the posterior vaginal wall. It may be complicated by laceration of the perineum.

*Signs.*—The discharge of feculent matter and flatus from the vagina at once shows the existence of a recto-vaginal communication; and examination with the finger, or inspection by introducing the duck-billed speculum, will reveal the situation and extent of the aperture.

*Treatment.*—The procedure for closing a recto-vaginal fistula must be determined primarily, according to whether the opening be simple, or complicated with laceration of the perineum.

*Simple Recto-vaginal Fistula*, if recent, and of small size, may perhaps be closed by cauterization gently with nitrate of silver, a red-hot wire, or the platinum loop, applied within the opening; the anterior wall of the vagina being well raised by the duck-billed speculum. An old fistula, and of larger extent, must be closed by a plastic operation. The bowels having been thoroughly emptied by aperients, and an enema on the morning of operation; the duck-billed speculum is introduced and the fistula, in the posterior vaginal wall, entirely exposed; the patient lying recumbent, with the legs raised and held apart, and the buttocks at the edge of the table, as for lithotomy. The Surgeon sitting opposite the perineum, he freely pares the margin of the opening; then, the edges are brought into even and easy apposition, transversely to the axis of the vagina; to effect which it will be necessary to divide the sphincter ani on either side, in order to overcome tension, and spasmodic muscular contraction after the operation. The sides of the opening are evenly secured in apposition by means of silver or platinum wire sutures; taking care to transfix the whole thickness of the gut, excluding its mucous membrane, and observing to bring the sutures through the vaginal mucous membrane half an inch beyond the pared edges, above and below. The sutures are fixed by a close twist of the wire across the line of aperture; or they may be passed through a perforated leaden shield, overlaying the aperture, then through split shot, and clamped with forceps close upon the shield, so as to fix it upon the vaginal wall. The ends of wire are snipped, and the operation completed. *After-treatment* is most important. It consists in preventing any action of the bowels for a week

or ten days, by keeping the patient under the influence of opium, until firm union is established. A laxative aperient, or an enema of castor oil and gruel, may then be administered. Cleanliness is also essential to success; the vagina being syringed with cold water, two or three times a day, and the urine drawn off by a catheter as occasion requires. About the end of a week, the sutures may be snipped through, and gently withdrawn. A small aperture, even a pin-hole opening, not unfrequently remains, and obstinately resists closure. This must be treated, as already described, by touching with nitrate of silver or the wire-cautery.

The *complication* of a *Lacerated Perineum* must be treated by the appropriate operation, described in connexion with that condition; the fistulous aperture being closed by paring, and sutures. I have thus succeeded in closing a recto-vaginal fistula, and subsequently a laceration of the perineum, which occurred in the same woman; and in whom also a tight annular membranous stricture of the rectum was cured, by dividing its free margin with scissors, at two or three points of its circumference, and which I then dilated as usual, by the occasional passage of a bougie.

(3) *Entero-vaginal Fistula* is a rare occurrence; a communication having formed between the small intestine and the vagina. This condition would simulate a recto-vaginal fistula; but it may perhaps be distinguished by the feculent discharge having a more yellow colour, and less stercoraceous character.

Such fistula is *incurable*. An operation has been performed by Roux and Casamayor, with the view of establishing a communication between the small and large intestine; but the deep and difficult dissection necessary for this purpose, has proved fatal.

**ANAL TUMOURS.**—Various forms of tumour and excrescence are liable to beset the Anus. They are principally; epithelial cancer, fibrous tumour, warts and condylomata. The nature of these growths is the same as when occurring in other parts of the body, and they are recognised and diagnosed by similar symptoms as in other regions.

The *treatment* is excision, which may generally be effected most conveniently by a stout pair of scissors curved on the flat. Chloroform, ice and salt, or the ether-spray, will be requisite; the operation being acutely painful, and spasmodic action of the sphincter interfering with its performance. Wet lint dressing is often sufficient; but a persistent oozing hæmorrhage must be arrested by application of the perchloride of iron or other styptic, and sometimes by the actual cautery, with a compress and T bandage. Subsequently, great cleanliness should be observed, to prevent any irritation which might induce reproduction of the morbid growth.

**ANAL CONTRACTION**, or stricture of the anal orifice, results from tight cicatrization, in consequence of the healing of ulcers or wounds of the anal integument. This may occur after operations of excision; as the removal of external piles, or of anal tumours.

The only *treatment* is dilatation, gradually effected by bougies or compressed sponge-tents. It is remarkable how small an opening will suffice for the purpose of adequate defæcation.

#### INJURIES OF THE RECTUM.

**Wounds.**—The Rectum is liable to *wounds* or *laceration* by external injury, as a severe kick in the fundament, or the introduction of a foreign

body; but more commonly from internal causes, as during straining efforts of defæcation, and the passage of large and hardened fæces, or in parturition. Wounds of the rectum may occur also accidentally, as in lithotomy, or unskilful catheterism; or surgically, in the operation of puncturing the bladder through the trigone vesicæ for the relief of retention of urine. Injury by wound or laceration may involve the whole thickness of the wall of the rectum, or the mucous membrane only; and it is evident that the lesion may vary in direction, as being vertical or transverse.

The *symptoms* will be sudden pain and hæmorrhage, occurring in connexion with some occasion of injury; and examination per rectum, may discover the seat and nature of the lesion. Defæcation is painful and the fæces are streaked with blood; and subsequently with pus, when suppuration ensues. Granulation and cicatrization follow, or the wound becomes an ulcer of the rectum.

*Treatment* consists, in keeping the bowels easy and free by mild aperients or emollient enemata, and the avoidance of stimulating food; with rest in the recumbent position. Cleanliness, after each evacuation, will do much locally to promote healing; but an intractable sore or ulcer should be brushed over with a solution of nitrate of silver occasionally. It may become necessary to make an incision through the mucous membrane, along the ulcer, as directed in the treatment of fissured anus.

*Foreign Bodies.*—All sorts of foreign bodies may be found in the rectum; having been swallowed, or introduced directly into the bowel through the anus, and sometimes maliciously. By either mode of entrance, the list of such substances on record is most numerous and diverse in their nature; and their variety is increased by those formed in the body and impacted in the rectum. Hence, may be found; concretions,—biliary, intestinal and fæcal; of substances swallowed,—the bones of fish and small bones, stones of fruit, coins, pins, needles, knives, nails, sealing-wax, cedar pencils, brown paper, &c.; and as introduced through the anus,—pieces of stick, ivory, cork, horn, metal, rings, ferrules, bottles, pots, cups, a shuttle with its roll of yarn, a knitting-sheath, a pig's tail, a broom-handle, the leg of a chair, &c.

The *symptoms* of any such foreign body impacted, will be pain, hæmorrhage, and obstruction; on examination, it will be found within the rectum, and sometimes sticking out of the anus. Any sharp spiculated body occasions the acutest agony, especially on the slightest motion, so that the sufferer becomes afraid to move. In one such case, the patient crawled into my consulting room, looking the picture of misery, and could only point backwards to the fundament. On examination, I immediately introduced my finger into the rectum, when about two inches from the anus, I touched a bar lying across the bowel and stretching it out at a point on either side. I dislodged this bar with a twist and withdrew it through the anus. It proved to be the rib-bone of a rabbit. The patient remembered having eaten rabbit a few days previously, and the night before I removed this faithful rib, he was suddenly seized with excruciating pain in the lower part of the bowel, aggravated as he rolled about with suffering during the night. The relief was instantaneous, leaving only a dull aching sensation which wore off in a day or two.

*Treatment* in any case must, of course, be extraction of the foreign body, as soon as possible. But this may be difficult to accomplish, according to the situation of the body, its size and nature.



Concretions offer some advantage over other substances. Emollient enemata of soap and water or olive oil, may do something towards softening feculent masses; thus facilitating their extraction or discharge, piecemeal. They can then be scooped out with a lithotomy-scoop or a table-spoon. Other foreign bodies present special difficulties, and each almost its own peculiar difficulty. Removal is effected by the finger or the hand, coupled with dilatation of the anus which admits of gradual enlargement so as to pass the whole hand; or instruments may be necessary. The *modus operandi* must then be left to the ingenuity of the Surgeon. Sir W. Fergusson extracted a bougie from the rectum of an old gentleman, by means of lithotomy forceps. In another case, which Mr. Liston relates, a pig's tail had been mischievously thrust by some students into the rectum of an old woman; the bristles were in the wrong direction for extraction of the tail, and by sticking into the mucous membrane, it resisted any attempt. At length, a tube was slid up between the bowel and the tail, when the latter was easily withdrawn. In other cases, it has been found necessary to divide or break the substance in order to remove it. And in yet other cases, removal has not been accomplished by any manipulation or instrument. Whether the foreign body be extracted or not; in not a few cases death has ensued from violent intestinal inflammation.

#### CONGENITAL MALFORMATIONS OF THE ANUS, AND RECTUM.

*Imperforate Rectum*, as a congenital malformation or deficiency, may exist in two primary conditions; imperforate anus; or, the anus leading into a cul-de-sac, imperforate rectum. The former condition—imperforate anus, presents five varieties; (1) simply membranous obstruction of the anus; (2) with partial or complete deficiency of the rectum; (3) communication with the neck of the bladder or the urethra, in the male; (4) communication with the vagina in the female; (5) external communication, or fistula. The latter condition—imperforate rectum, presents two varieties; (1) membranous obstruction; (2) partial or complete deficiency of the rectum.

*Signs.*—When, after birth, there is no *evacuation* during the first thirty-six or forty-eight hours, of the usual dark-coloured meconium fluid, and perhaps sickness co-existing, the medical attendant or the nurse, is led to discover that the *anus* is *imperforate*; if indeed this deficiency had been overlooked at the time of birth. The condition of the rectum, when obstructed, is almost sure to be undiscovered at birth; but if *no bulging* in the fundament be perceived after some hours have elapsed,—the anus being imperforate—the lower end of the *rectum* will probably be deficient. *Imperforate rectum* is distinguished by the presence of an anal cul-de-sac. The finger can sometimes be introduced into this sac to the extent of its depth,—half an inch to an inch and a half. Those varieties of imperforate anus in which a *communication* exists, with the bladder, the vagina, or externally, admit of less direct recognition during life. But the discharge of feculent fluid through the urethra, the vagina, or an external fistulous opening, will be severally diagnostic of these malformations. In the latter state, the situation of the opening varies in the two sexes. In the male, the fistulous opening may be in the perineum just behind the scrotum, in the scrotal raphé, or anterior to the scrotum. In the female, it occurs in the perineum close to the vagina, or at the posterior commissure of the vulva. In both sexes, and in all these situations,—vesical, vaginal, and perineal, the vent is insufficient and defæcation

more or less difficult. Hence, constipation and intestinal dilatation ensues, especially as the faeces acquire consistency, and sooner or later, life becomes endangered.

All the foregoing malformations seem to occur more commonly in male children than in female. Thus of 100 cases collected by Mr. Curling, 68 were males and 32 females. But of 100 cases recorded by M. Bouisson, 53 were females, and 47 males. So, therefore, the liability of sex is doubtful.

*Treatment.*—Operative interference is necessary or becomes necessary, to preserve life, in consequence of the anal or rectal obstruction; or to remove a wretched and disgusting infirmity, in the cases of fistulous communication, or of an external perineal opening. The principle of operation, is to remove the obstruction by the formation of an anal opening in the situation of the natural anus,—the establishment of an artificial anus in the natural situation; or by the enlargement of a fistulous communication at a distance off,—in the left iliac region, or the left lumbar region, respectively, by Littré's or Amussat's operations.

*Imperforate Anus*, as a simply *membranous* obstruction, may be easily remedied. The integument over the seat of the termination of the rectum is usually so thin that the meconium can be distinguished by the dark blue or black colour of the skin; and bulging, becomes plainly visible when the child cries. A central crucial incision should be made with a sharp-pointed bistoury, and the four angles of the integument excised. The aperture must then be maintained by the introduction of an oiled tent or the passage of a bougie daily, until the anus is fully established, which seldom requires more than a week.

*Deficiency of the rectum*, co-existing with imperforate anus, should be managed on the same principle. An incision is made at the site of the anus, exactly in the middle line; and then the dissection must be prolonged cautiously towards the coccyx, extending to the depth of an inch and a quarter. The closed termination of the bowel may thus be reached, or, in the course of a few hours, it comes into view, being forced down by the infant's crying. When reached, the bowel must be opened freely with the bistoury, then drawn down to the external wound, and there attached by sutures. After this procedure, the same precaution will be requisite as before, in order to see that the anus shall become permanently established; a bougie should be passed occasionally for several weeks. In the event of a failure to reach the bowel, colotomy must be performed, in the left iliac region.

*Imperforate rectum*—the anus opening into a cul-de-sac, necessitates similar operative interference. By dilating the cul-de-sac with a sponge-tent, for a few hours, the seat of operation is rendered more perceptible. Then, on introducing the finger into the anal cul-de-sac, if the obstruction is membranous, the termination of the distended rectum can be distinctly felt as a thin septum under the point of the finger. This may be opened by an exploratory puncture with a grooved needle or fine trocar, and if meconium fluid or gas escape, a free aperture should be made with a sharp-pointed bistoury. If the distended end of the bowel cannot be felt, the anal cul-de-sac should be enlarged by an incision, carried towards the coccyx, so as to divide the posterior wall of the sac; and search made in this direction to the depth of an inch and a half or two inches from the anus. Failing to reach the bowel, further operation should be abandoned, and colotomy, in the left iliac region, resorted to.

*Rectal communications* with the bladder, vagina, or perineum—co-existing with imperforate anus, may require operative interference, eventually, to preserve life, as constipation and intestinal dilatation supervene; and in any such case, interference will be justifiable to relieve and render tolerable the otherwise wretched state of existence.

In the case of a communication with the *bladder*, the opening is situated at the neck of the bladder, or more commonly at the anterior part of the prostatic portion of the urethra; it is not usually direct, but through the medium of a narrow channel, and is always small and insufficient. But, the urethral aperture appears to be usually of a valvular character, so that although feces can pass into the urinary canal, the urine is unable to enter the rectum. The same operation should be performed as in the condition of imperforate anus coupled with deficiency of the rectum. Anussat, in 1835, first proposed that the end of the bowel should be brought down and secured to the integumental wound at the site of the anus; a proceeding much advocated by Dieffenbach. A passage lined with mucous membrane is thus made for the escape of the feces, and the liability of feculent extravasation averted, and its consequences, diffuse cellulitis and peritonitis. Colotomy must be had recourse to, when the bowel is seated at a depth beyond an inch and a half to two inches.

Rectal communication with the *vagina*, or a fistulous opening in the *perineum*, may be remedied by either of two operative procedures—enlargement of the original outlet, or the formation of a new anus at the natural site, and closure of the abnormal anus.

Recto-*vaginal* communication has been cured in both ways. Enlargement of the original outlet, first suggested by Vicq-d'Azyr, is effected by division of the posterior wall of the vagina and the perineum as far as the coccyx, and retaining a canula in the bowel. A similar operation was performed by Dr. Barton of Philadelphia, and another by Dr. Parish of the same city. In the one case, the infant was aged nine months, in the other fifteen months. To establish a new passage at the natural site, a curved director or sound should be passed through the recto-vaginal opening into the bowel, with its point directed to the site of the anus; this is then cut up in the middle line, the incision being carried backwards towards the coccyx. A free opening having thus been made in the bowel, it is brought down and secured by sutures to the margin of the integumental wound. Dilatation must subsequently be maintained. Closure of the abnormal communication with the vagina may take place spontaneously; as in a case operated on by Dr. Sharpless of Philadelphia, where the opening closed two months after the substitution of the operation-anus. Generally, it will be necessary to assist contraction and closure by touching the edges with the actual cautery; or, if the opening be large, the edges must be pared and brought together by sutures. After either procedure, the bowels should be kept at rest by opiates, for several days, until closure has taken place.

Recto-*perineal* communication, as the third variety of imperforate anus, has also been treated successfully by both modes of operation. Enlargement of the original outlet is performed by an incision towards the coccyx, and the application of sutures. The results of this procedure were quite satisfactory in two cases operated on by M. Goyrand; one, a male infant, six months old, in whom at the age of sixteen years, defæcation was free and the power of retention complete, even when the



motions were lax; the other, a female, aged eleven months. Equally satisfactory results have been obtained by Mr. Gowlland and by Mr. Curling, in a male, and a female infant, respectively. The formation of a new anus at the natural site has proved successful in the hands of M. Guillon and others. But, enlargement of the original outlet will be preferable in all cases where the opening is sufficiently near the site of the natural anus; this is generally the condition in the female, and sometimes in the male. When, however, the opening is situated beneath the penis, or in the scrotal raphe; the other operative procedure must be resorted to.

The general *result* of unrelieved and long-continued rectal-obstruction, is well shown in a case of imperforate anus with recto-vaginal fistula, operated on by Mr. Lane; the child being four and a half years old. The bowel was opened at the anus, and the septum between the two apertures was divided. Death ensued in twenty-three days. The continual strain upon the rectum had produced distension to a size almost incredible; the rectum and sigmoid flexure of the colon forming an immense reservoir capable of holding five pints of fluid, which occupied the pelvis, the hypogastric, both iliac, and part of the umbilical regions, displacing the viscera upwards and diminishing the cavity of the thorax.

#### FUNCTIONAL DISORDERS OF THE RECTUM AND ANUS.

Under this head may be conveniently noticed certain functional disorders, which are unaccompanied with any structural condition of disease of the part affected, whether the Rectum or Anus. Such are Atony of the Rectum; Irritable Rectum, or Sphincter; Neuralgia of the Rectum, or of the Anus; Pruritus Ani.

*Atony of the Rectum.*—In paraplegia the retentive powers of the rectum and of the sphincter are both lost; but the tonic muscular power of the rectum may itself be deficient, rendering the bowel incapable of thoroughly expelling its contents. Fæcal accumulation is apt to ensue. This occurs in habitual rectal constipation; a state in which the fæces are transmitted through the colon into the rectum, but there lodge.

Besides the ordinary symptoms of constipation; there is also a sense of fulness and weight in the rectum, and severe bearing-down pains occasionally. A mucous discharge resulting from constant irritation, may bring away a little feculent matter from the surface of the mass, and simulate diarrhœa.

The cause of this atonic condition is usually the too frequent and copious use of enemata, a practice more common on the Continent than in this country. French ladies are, I believe, especially subject to the complaint, through the prevalent custom with them more particularly of neglecting the calls of Nature, and then seeking relief by lavements. It occurs also among the enfeebled by age.

The *treatment* of fæcal accumulation in the rectum should be chiefly mechanical. Impacted and indurated fæces may be broken up and scooped out, by means of a lithotomy scoop or a dessert-spoon. Injections, in the first instance, have but little effect in dissolving the accumulation, and generally return immediately; after extraction of the larger lumps, the remainder may be thus removed, and the bowel washed out.

*Irritable Rectum.*—In this functional condition of the rectum, there is frequent and urgent desire to deæcate; analogous to the frequent and urgent desire to micturate, as denoting irritability of the urinary bladder. And the analogy between these two affections holds good still further, in

the common cause of rectal irritability being an unhealthy and irritating state of the fæces, in consequence of gastro-intestinal derangements; just as vesical irritability depends frequently on morbid conditions of the urine. Both affections also depend often on morbid states of the nervous system, and are much influenced by the attention being directed to the part. Various diseases also of the bowel may give rise to its irritability, and in particular, ulcer of the rectum; but the irritability is not then purely functional.

The treatment of rectal irritability must have reference to these diverse causes—whether the state of the alvine evacuations, or of the nervous system, or the associated diseases of the rectum.

Opiate suppositories are most effectual in restraining the distressing inconvenience of an irritable rectum.

Irritability of the *sphincter* alone, is sometimes met with, unaccompanied by any apparent disease of the part. It occurs usually in hysterical females. Pain and difficulty in defæcation are experienced, owing to spasmodic contraction of the sphincter, resisting the expulsive power of the bowel; and when the finger is forced in, it is tightly grasped by the muscle as if girt by a cord. In old-standing irritability, the muscle often becomes hypertrophied, encircling the finger like a thick unyielding ring.

The *treatment* of this affection consists in mild laxative aperients to insure soft motions, and sedative applications. An ointment containing chloroform, opium or belladonna, should be used by means of a grooved-bougie; so that some of the sedative shall reach the mucous membrane lining the internal sphincter which is also occasionally affected. The simple introduction of a bougie appears to afford great relief, when resistance to the evacuation of fæces is considerable. In obstinate cases, and especially when the sphincter has become hypertrophied, a slight incision into the muscle will usually give relief. It should be done on one side, towards the ischium. Constitutional treatment as in other hysterical affections, must be attended to; but often after having failed in every way to overcome this troublesome affection, it ceases spontaneously.

*Neuralgia of the Rectum.*—This affection, unlike irritability, is essentially a painful affection of the rectum, and always unaccompanied by any discoverable disease of the part. The character of the pain is neuralgic, in its being intensely severe, and not excited or aggravated by the action of the bowels or by pressure. But, it is not so distinctly paroxysmal, coming suddenly and after a while disappearing; it is singularly persistent, although varying in intensity at different times; and may continue for years. The pain does not seem referable to any particular spot, extending perhaps up one side of the bowel, as a dull aching pain. This affection of the rectum occurs chiefly in females.

No *treatment* can be designated curative. Sedative applications may have some influence in allaying the pain; opiate suppositories in particular, or the belladonna ointment introduced by a bougie. Constitutional treatment should not be neglected; colchicum and bicarbonate of potash may prove beneficial in a gouty diathesis; or quinine and iron in persons debilitated and worn down by suffering.

*Pruritus Ani.*—Itching at the anus, unconnected with any diseased state of the part, is symptomatic of various causative conditions. Rectal constipation, ascariides, congestion of the mucous membrane, not distinctly hæmorrhoidal, and other disorders of the bowel; are common causes. The complaint may also be sympathetic; as of chronic enlargement of the prostate, or of some uterine or ovarian irritation. Anal itching and

irritation are usually more intolerable at night, depriving the patient of sleep; it is frequently provoked during the day by sitting long upright. Scratching or rubbing the part only aggravates the suffering, and results in excoriation, or the production of a peculiar dry, harsh, and leathery state of the skin, easily disposed to crack.

*Treatment* of this affection consists in removing any exciting cause, and using sedative applications. Hence, it will be imperative to regulate the bowels, and avoid any stimulating condiment, food or drink; or the removal of ascarides may be indicated as the source of irritation; and in any case, absolute cleanliness must be enjoined. Of topical applications; the liquor opii sedativus, chloroform ointment, or vapour, will often prove effectual. The latter may be applied by pouring a little chloroform into a wine-glass which is held to the anus. Mr. Curling highly recommends a lotion composed of a drachm of the sulphuret of potassium and eight ounces of lime-water; the infusion of tobacco with five grains of borax to the ounce, is also very efficacious. In chronic cases, astringent lotions are often beneficial; as lotions of alum, tannin, or the muriated tincture of iron. Counter-irritation, I have found to be singularly remedial, when the anal itching depends on ovarian irritation; a blister applied over the iliac region, on the tender side, has not unfrequently acted as a charm, all other treatment having been quite ineffectual.

## THE GENITO-URINARY ORGANS.

### CHAPTER LVII.

#### INJURIES AND DISEASES OF THE BLADDER—AND URINARY CALCULUS.

THE Genito-Urinary Organs comprise, the kidneys, ureters, bladder, prostate gland, urethra, penis, scrotum, and testis,—in the male; the uterus and ovaries, the vagina and vulva,—the organs of generation in the female. Of these organs, the kidney in respect to its diseases, falls within the allotted province of Medicine, and incidental notice only will be taken of the ureter in this work. But the Student in Surgery must equally study renal diseases as part of the pathology of the urinary system.

The Bladder, lodged within the bony walls of the pelvis, is less liable than many other organs to external Injury, as wounds or rupture; and only occasionally, to the intrusion of foreign bodies from without, through the urethra or by gunshot penetration; but it is very commonly the receptacle of urinary concretions or Calculi, and it is subject to various Diseases, principally inflammation and morbid growths or tumours. This organ is also specially prone to Functional Disorders; *e.g.*, irritability of the bladder, arising from numerous causes, local and constitutional.

These lesions, diseases, and disorders, severally demand the attention of the Surgeon, in regard to their special pathology and treatment.

*INJURIES.*—*Laceration* of the bladder occurs not unfrequently with fracture of the pelvis, this additional injury being a most serious complication in consequence of the extravasation of urine. An open wound, as by a bullet, may allow the urine to escape freely, externally; and recovery has then been known to ensue. Several such cases are related by Guthrie,



and by Thomson as having occurred at the battle of Waterloo. *Rupture* of the bladder is also not very uncommon, as the result of blows, kicks, or contusions on the lower part of the abdomen; especially when the bladder is fully distended and rises above the pubes in contact with the abdominal wall. Thus, this accident may occur from a fall in wrestling, the uppermost man coming down upon his antagonist; or from running against a post in the dark, an instance of which is related by Liston. In that case, a large calculus which occupied the bladder, was shattered into fragments by the concussion.

The *effects* of laceration or rupture of the bladder vary according to the seat of injury, as above or below the reflection of the peritoneum; whereby extravasation of urine takes place into the peritoneal cavity, or into the cellular tissue of the pelvis. In the one condition, fatal peritonitis speedily ensues; in the other, diffuse inflammation is followed by sloughing of the cellular texture of the pelvis and abdominal wall as infiltration proceeds, and a less speedy termination.

The *symptoms* of ruptured bladder are obvious; sudden and intense burning pain, in the hypogastric region, with immediate collapse, and inability to pass water or a little bloody urine coming away through the urethra. On introducing a catheter, the bladder is found to be empty, or a small quantity of bloody urine is drawn off. In gunshot wound implicating the bladder, the urine may perhaps be seen to escape through the track of the wound.

*Treatment.*—Extravasation should be immediately prevented extending further, by the introduction of a full-sized gum-elastic catheter into the bladder; which is retained by means of tapes, that the urine may dribble away as fast as it descends into the bladder. Any appearance of extravasation presenting externally, must be at once met by free incisions; so that the infiltrated fluid may escape, and sloughs as they form. By this prompt prevention of further extravasation and arrest of the diffusive inflammation in the cellular texture, a circumscribing barrier of lymph may be thrown out, and life be preserved. Peritonitis, consequent on extravasation into the peritoneal cavity, may also be diminished by using the catheter as directed, but the fluid already imprisoned within the peritoneum will still maintain the inflammation. The general treatment consists in the administration of opium and stimulants, with whatever nourishing food can be taken to support the patient through the subsequent exhaustion, especially in the process of sloughing.

*Rupture of Ureter.*—This rare form of injury has been known to happen from external violence, and recovery in one instance at least. In a case which Mr. Stanley has recorded, a large accumulation of fluid formed around the seat of injury, with considerable circumscribed swelling and fluctuation, which was repeatedly tapped. Ruptured pelvis of the kidney, in another case, led to the formation of a similar cystic collection of urine behind the peritoneum; and no less than six pints of urine were drawn off by tapping, at one sitting. Death occurred about ten weeks after the accident.

*Foreign Bodies.*—Various foreign bodies, such as portions of catheters, or bits of pencil or tobacco-pipe, are occasionally thrust into the bladder, through the urethra. Any substance thus introduced, is usually of some length, and lying perhaps across the bladder, is rarely expelled in passing water; it must therefore be extracted surgically. This may sometimes be done with a lithotrite, by catching the body in the direction of its long

axis, or by crushing the substance as a stone; but sometimes it has been found necessary to have recourse to the operation of lithotomy. Knowing the size and shape of the foreign body, the median operation can be more frequently selected. Bullets, bits of clothing or other bodies, are occasionally lodged in the bladder by gunshot wound, implicating this organ. Any such body must be removed in like manner. In fifteen cases, which Mr. Dixon has collected, the ball had entered the bladder, either primarily, or in consequence of abscess and ulceration after having lodged near this organ; and in ten of these cases, the ball was removed by the operation of lithotomy, with successful results. Of the remaining five cases, the termination is not recorded.

In all cases, a foreign body in the bladder soon becomes encrusted with urinary deposit; and by thus increasing the difficulty of its extraction, and as a persistent source of irritation, inducing an unhealthy state of the bladder, the result of any operative procedure might be unsuccessful.

### URINARY CALCULUS.

Urinary Calculus, or stone, signifies a concretion of one or more of the constituents of the urine, forming a hard mass.

*Origin.*—It originates from the precipitation of urinary constituents, as Urinary Deposits,\* in consequence of a loss of solvent capacity in the water of the urine. This may arise in one of three ways; by an excess of any substance for the water to dissolve, by a deficiency of water for solution of the substance; or by the presence, or absence, of some third substance. In either way, different natural analyses of the urine occur: precipitating urinary deposits and resulting in the formation of urinary calculi.

*Production.*—The deposit may aggregate from a focus of its own substance, more frequently it gathers around a foreign body as a distinct nucleus; in either way producing a calculus. In the former mode of production, aggregation is due; either, to an excess of insoluble constituents and thence their immediate precipitation, as in the ordinary forms of uric acid, urate, and oxalate concretions; or, to stagnation of the urine in the bladder,—in consequence of paralysis, chronic inflammation and hypertrophy of the organ, enlargement of the prostate, or stricture of the urethra, all of which conditions severally lead to the retention of urine, and perhaps affect its chemical constitution,—as in the formation of phosphatic calculi. When a calculus forms around a distinct nucleus, this is some foreign body; either a small clot of blood or mucus derived from the urinary organ in which the calculus originated, or it may be some small foreign body introduced from without into the bladder through the urethra, or by wound or ulceration of the organ.

The constituents of a calculus are held together by some kind of cement, which is believed to be animal matter; mucus, fibrin, or fatty matter; or it is said, possibly blood, epithelium, or even pus.

The *seat* of origin in the urinary organs, may be either the kidney or the bladder, and thence a calculus is designated *renal* or *vesical*; usually it originates in the kidney, and subsequently descends as a small stone into the bladder, where it increases by further concretion.

Urinary calculus differs in its physical characters, and chemical composition; thus representing different classes and species of Urinary Calculi.

\* The reader will find a "Practical View of Urinary Pathology and Deposits," in the second edition of the Author's work on the Irritable Bladder, its Causes and Treatment.

*Physical Characters.*—Urinary Calculus varies in point of size, shape, weight, colour, odour, consistence, structure on section, and number. The *size*, is extremely variable; from that of a hemp-seed, pea, nut, or almond, to a cricket-ball and occupying the whole cavity of the thickened bladder. Of such large-sized calculi, one may be seen in the Museum of the Royal College of Surgeons, and another in the valuable collection of the Norfolk and Norwich Hospital Museum. That in the College collection measures 16 inches around its long axis, and 14 inches around its short axis; it weighs 44 ounces. An unsuccessful attempt was made by Mr. Clive to remove it from Sir Walter Ogilvie, who died on the tenth day. A nearly similar sized stone was removed by Uytterhoeven of Brussels, by the high operation. Phosphatic calculi usually attain the largest size. The *shape* also varies remarkably, and principally according to the situation and composition of the stone. Renal calculus is irregular, and often moulded to the form of the calices and pelvis of the kidney; in the ureter, a stone is generally cylindrical; the vesical is more uniformly of a flattened ovoid shape, or globular; while the prostatic is pear-shaped or singularly faceted. In relation to composition; uric acid and urate of ammonia calculi are usually smooth and regular; the oxalates tuberculated like a mulberry,—hence the common name of this calculus; the phosphatic, may be smooth and regular, or irregularly contorted. Many other forms are met with, which being readily recognised, need not be specified. The *weight* depends more on the composition than the size of the stone; the phosphatic being very light, the oxalates very heavy, and uric acid or urates between the two. The average weight is an ounce; but extremes have been met with; in a stone of 10 grs. taken from a boy; another of nearly 6 ounces, removed by Sir A. Cooper, and another of 32 ounces, in the Museum of Trinity College, Cambridge. Of heavy calculi not removed, Deschamps saw one that weighed 51 ounces; and Morand, one weighing 6 lbs.—the heaviest on record. The *colour* of a calculus represents only the chemical nature of the surface or external crust of deposit; the interior is often very different. A white surface signifies a phosphatic crust; a cinder-gray, that of urate of ammonia; a yellow pale brown, or brown, the uric acid; cinnamon-brown, the uric or xanthic oxide; a mahogany brown, brownish or blackish green, the oxalate of lime; a gray-greenish or slate colour, the cystic oxide. The *odour* of a recently extracted calculus is sometimes peculiar. Phosphatic calculus may be ammoniacal, and oxalate of lime, on section, is said to emit a faint odour of semen. An aromatic smell, as of castor or musk, is sometimes perceptible. The *consistence* varies from that of mortar or sand to that of granite. But this will depend on the chemical nature of the calculus and on the intermixture of organic matter, or moisture in a recently extracted stone. Phosphatic calculus is generally soft; the uric acid hard; and the oxalates, very hard. The crust is usually softer than the interior, and the nucleus has the densest consistence. A rapidly formed stone is softer than one of slow production.

*Structure.*—On *section*, a calculus generally presents a nucleus, and the surrounding concretion, which has a more or less distinct external crust. The colour and consistence of the section may be uniform, when the stone consists of only one chemical constituent,—forming a *simple* calculus; or it varies in appearance at different depths, when consisting of different elements,—forming a *compound* calculus. The disposition of the concrete matter may be continuous,—presenting no visible arrangement; but usu-



ally it is deposited in concentric layers or laminæ, and sometimes lines radiate from the centre to the circumference of the stone. Varnishing the dried surface will exhibit its appearance most distinctly. This laminated arrangement, corresponds apparently to the successively active periods of urinary deposit. Such is Prout's explanation; and it would seem therefore, that a continuous concretion must be due to an uninterrupted deposit. Lamination may occur in the formation of both a simple and a compound calculus. It depends apparently on varying states of the urine. When some length of period intervenes in the deposition of matter, the surface of the concretion becomes water-worn, and worm-eaten; fresh deposition is less firmly adherent, and consequently a calculus thus constructed is disposed, when broken, to split into its concentric laminæ. In compound calculus, the successive deposition of different matter may be in a regular alternation. The *nucleus* is situated usually in or near the centre of the calculus; sometimes it is very eccentric, as in some renal concretions. Occasionally, more than one, or possibly several nuclei may be found, as distinct centres of concentric deposition. More rarely, the nucleus is loose within the substance of the calculus; owing apparently to a layer of blood or mucus having gathered around the nucleus, and then the concretion taking place on this layer. When the organic matter dries and pulverizes, the nucleus is left loose in the stone. Lastly, the nucleus may have disappeared, leaving a central cavity; a result probably of the nucleus itself having been blood or mucus, which has disappeared.

The *number* of calculi varies chiefly according to the seat of the stone. In the bladder, usually there is only one; in the kidney, two or more; and in the prostate, several. Vesical calculi are, however, sometimes numerous; two to six or eight are not very uncommon; and instances are on record of 117; 142 about the size of marbles, were removed by Sir A. Cooper; 307, 678, and even 1000 have been found; the latter number having been extracted by Dr. Physick from an American Judge. This number is the largest on record; the stones varied in size from partridge shot to a bean.

*Chemical Composition.*—In regard to their essential constituents, urinary calculi, like deposits, may be divided into two classes; a third class represents the more rare forms. (1) Calculi consisting of uric acid and the urate of ammonia; with their varieties, the oxalate of lime, uric or xanthic oxide, and cystic oxide or cystine; (2) phosphatic calculi, in all their varieties, as phosphate of ammonia and magnesia, phosphate of lime, and mixed phosphates of lime, magnesia and ammonia,—constituting the fusible calculus; (3) the fibrinous uro-stealth, carbonate of lime, and silicious calculi.

The *relative frequency* of different Calculi varies in different countries. Dr. H. V. Carter's observations, on the composition of more than 100 specimens in the Grant Medical College, Bombay, show the relative frequency of the different urinary constituents, as forming the nucleus and the body of calculi, in India and in England. (1) That in Bombay, the proportion of calculi having oxalate of lime for their nucleus, or wholly composed of it, is about twice as great as in England; taking for comparison certain standard collections of calculi in this country. (2) That the proportion of calculi having uric acid or a urate for their nucleus or entire substance, is considerably less in India than in England; in the former country, urate of ammonia calculi are somewhat more frequent than uric

acid calculi, and conversely in England. (3) That the number of calculi wholly composed of earthy phosphates, or having them for a nucleus, is proportionately much fewer in India than in England, owing chiefly to the rarity of the mixed phosphate in the former country.

Urinary calculi may be severally *distinguished* both by their physical characters, and by chemical tests; sometimes also by the crystalline forms of their constituents, as shown by microscopical examination.

Physical properties are most readily recognised, but they are least definite and distinctive; Calculi will, therefore, be described in the order of their chemical affinity, with regard to *Tests*.

*Uric, or Lithic Acid Calculus.*—The most common of all calculi, is that consisting of lithic acid. It was discovered by Scheele in 1776. Its colour is generally light brown, varying however from pale brown to dark brown; and sometimes whitish on the surface, owing to its having become coated with amorphous urate of ammonia or with phosphate of lime. The shape is usually ovoid, and somewhat flattened; the surface smooth, or beset with small tubercles, so as to resemble the surface of oxalate of lime-calculus; the size varies from that of a pea to an orange; and its consistence is hard in proportion to the purity of the calculus; sometimes emitting a ringing sound on percussion, and breaking up into sharp angular fragments. The calculus is composed of concentric laminae, and presents lines or fibres radiating from the centre to the circumference of the stone; both these appearances are marked in proportion to the purity of the calculus, and determine the lines of fracture when the stone is broken. The nucleus may be quite white, although consisting of pure uric acid; owing, as Dr. G. O. Rees has shown, to the absence of colouring matter. The fracture is crystalline. *Tests*:—Combustible, and destroyed by heat; turned red by nitric acid, forming a murexide; soluble in carbonate of potash, evolving *no ammonia*.

(2) *Urate of Ammonia Calculus.*—This is not a common form of calculus, urate of ammonia being soluble in warm urine; and it is generally confined to children. It was discovered by Fourcroy and Vauquelin in 1798. The colour of this calculus is that of clay or slate, and pretty characteristic, but less so when inclining to red or brown; it has an ovoid shape, and a smooth or slightly tuberculated surface, and is of small size; the section is homogeneous, seldom presenting a distinctly concentric laminated condition. Fracture is earthy,—not crystalline. *Tests*:—Combustible, and destroyed by heat; turned red by nitric acid, forming a murexide: soluble in carbonate of potash, evolving *ammonia*.

Urates of *Soda* or *Lime* are not found as calculi; these urates are mixed with urate of ammonia or uric acid in compound calculi.

(3) *Uric or Xanthic Oxide.*—A very rare calculus, four specimens only having been recorded. It was discovered by Dr. Marcet in 1815. The calculus has a cinnamon colour, a somewhat flattened shape and small size,—resembling a flattened pullet's egg, in a stone examined by Stromeier; its texture is hard and laminated. Fracture, not crystalline. Uric oxide bears a close relation to uric acid, and results apparently from an imperfect oxidation of the chemical material which forms uric acid. *Tests*:—Combustible, and destroyed by heat, but not turned red by nitric acid; soluble in ammonia, *not* crystallizing when evaporated; insoluble in carbonate of potash.

*Cystic Oxide, or Cystine Calculus.*—This also is a rare calculus,

discovered by Wollaston in 1810. It has a yellowish-brown colour, approaching that of the uric acid calculus, but after long exposure, it changes to a peculiar gray-greenish or slate colour; there is also a characteristic waxy, glistening, and slightly transparent appearance. Rounded and smooth or tuberculated, and of small size, the consistence is soft and pulverescent; a section exhibits no tendency to concentric laminae, and only very imperfect radiation. The fracture is crystalline; powder scraped with a knife is perfectly white, whether the stone be brown or green. Hereditary disposition to the formation of this calculus is strongly evinced; in 22 cases, 10 occurred in four families, and in 3 cases, the subjects were brothers. Cystic oxide calculus differs from all others chemically, in containing a large proportion of sulphur—about 26 per cent. It originates in the kidney, and not in the bladder as its name might imply. *Tests*:—Combustible, and destroyed by heat, but not turned red by nitric acid; soluble in ammonia, crystallizing when evaporated in six-sided plates; soluble in strong caustic potash.

(5) *Fibrinous Calculus*.—Described by Dr. Marcet and Dr. Prout; this rare calculus so called, seems to have occurred in the form of pea-shaped bodies, of a yellow colour, and consisting of dried, coagulated albuminous matter. It can scarcely be regarded as a concretion;—although such masses have presented considerable lustre and a vitreous fracture; resembling yellow wax in appearance. *Tests*:—It may be distinguished from cystine, by being soluble with difficulty, in ammonia, and not crystallizing when evaporated.

(6) *Uro-Stealth Calculus*.—Another very rare pseudo-form of calculus, consisting of resin or fatty matter. It was originally described by Heller in 1844; several small bodies of this kind having been passed by a man, aged twenty-four, who suffered from symptoms of stone. Since that time, Dr. Moore of Dublin has examined several specimens sent to him by Dr. Robert Adams. *Tests*:—Soluble in ether and caustic potash; insoluble in boiling water and nearly so in alcohol; when heated and melted, the odour of benzoin is emitted.

(7) *Blood-Calculus*, consists apparently of disintegrated blood-corpuscles associated with phosphate of lime; it therefore represents another form of pseudo-calculus, and which is also very rare. Described by Dr. Alison, and examined by Dr. G. O. Rees; a few such calculi were found in the pelvis of the kidney of a man who died of consumption. They had a black colour, and ranged in size from a coriander-seed to a small horse-bean; they were friable, and the fractured surface presented an amorphous, dark rusty appearance. *Tests* seem to have elicited nothing peculiar; the calculus matter was partly combustible, and soluble in liquor potassæ.

(8) *Carbonate of Lime Calculus*.—An extremely rare form of calculus, discovered by Brugnattelli in 1819. Of a perfectly white or an ash colour, spherical or irregular, and varying in size from a pea to a nut or larger; the consistence is usually soft and friable, but sometimes very hard. Section shows no concentric laminae or only an imperfect lamellar structure. The texture is amorphous. Prostatic calculi consist almost entirely of carbonate of lime, as Dr. Thudichum has shown; but it is always doubtful whether the lime or the carbonic acid were in any case derived from the urine. *Tests*:—Not combustible, and not destroyed by heat; soluble with hydrochloric acid, effervesces *before* heating; soluble in acid, when neutralized, gives a precipitate with carbonated alkalies and oxalate of ammonia.



(9) *Oxalate of Lime Calculus*.—This is the next most common after the uric acid calculus. It was discovered by Wollaston in 1797, but the nature of oxalic acid deposit was long afterwards originally investigated by Dr. Golding Bird. The colour is rich mahogany brown, or sometimes blackish-green; the shape spheroidal, and surface tuberculated, angular, or even spinous, rarely perfectly smooth; and varying in size from a marble to a horse-chestnut. This remarkable colour and external appearance, have given the special name “mulberry” to the oxalate of lime calculus. Its density and weight are great; and section shows an imperfectly laminated structure of irregular waved lines, often resembling knotted heart of oak; occasionally,—a notably radiated appearance, like a series of minute needles placed side by side. The fracture is crystalline. Dr. Lionel Beale has specially traced the formation of this calculus, from an oxalate of lime concretion not larger than 1-500th of an inch; and he finds that dumb-bell crystals are first aggregated together into a small collection, in the interstices of which crystalline matter is deposited, forming a microscopic calculus.

Varieties of appearance are produced by the deposition of crystallized oxalate of lime on the surface of the calculus; sometimes as a coating of transparent octahedrons, or it may be opaque; and the calculus looks as if studded with pearl-spar. The deposition also of amorphous matter, as urates or phosphates may fill up the intervals between the tubercles or spines, and give the whole an ovoid shape. In compound calculi, oxalate of lime deposition presents the beautiful appearance of fortification agate.

Rarer *varieties* are occasionally met with. The small, smooth, globular “hemp-seed” calculus, of a light brown colour. Also, the calculus, of a white or pale brown colour, and crystalline throughout. Lastly, the pure white oxalate of lime calculus. These varieties are generally found in the kidney. *Tests*:—Not combustible, and not destroyed by heat; soluble with hydrochloric acid, effervesces *after* heating; solution in acid, when neutralized, gives a precipitate with carbonated alkalies and oxalate of ammonia.

(10) *Phosphate of Ammonia and Magnesia*—or *Triple Phosphate*.—Discovered by Wollaston in 1797, this calculus is not common. It is of a white or gray colour, irregular shape and somewhat spiculated, may attain a large size, and has a friable consistence; is imperfectly laminated, and the fracture sometimes crystalline like alabaster. *Tests*:—Not combustible, and not destroyed by heat; soluble with hydrochloric acid, but does *not* effervesce either *before* or *after* heating; solution in acid, with excess of ammonia, gives a crystalline precipitate.

(11) *Phosphate of Lime Calculus*—also discovered by Wollaston in 1797, is rarely found in the bladder uncombined with other salts; and it seldom forms the nucleus of other calculi. It has a pale brown colour; spheroidal form and smooth surface; is usually small, friable, and laminated. This condition of the calculus is of renal origin, and consists of the neutral phosphate of lime. Another condition is of vesical origin, and consists of bone-earth phosphate; it occurs in the shape of irregular masses resembling mortar, or a granular semi-crystalline powder, enveloped in a tenacious mucus. Phosphates form around other calculi, or foreign bodies; but they are scarcely ever succeeded by a deposit of uric acid or urate of ammonia, or of oxalate of lime. *Tests*:—Not combustible, and not destroyed by heat; soluble with hydrochloric acid, but does *not* effervesce either *before* or *after* heating; solution in acid, with excess of ammonia, gives an amorphous precipitate.

(12) *Phosphate of lime, and phosphate of magnesia and ammonia calculus—or the Mixed Phosphates—Fusible Calculus.*—Another discovery by Wollaston in 1797, this is the most common of the three phosphatic calculi, and represents rather more than 1 in 12 of all calculi. The calculus is of a white, gray, or dull yellow colour; generally of a very irregular shape, and moulds itself to the situation where found; sometimes globular or ovoid, sometimes in many pieces and assuming a cubic or tetrahedral form. It may attain a considerable size, and has a very friable consistence and pulverescent character, or a soft consistence, resembling moist chalk. Section shows generally a concentric lamellar structure, and sometimes shining crystals of the triple phosphate between the laminæ, or a semi-crystalline appearance. The relative proportion of the constituent phosphates varies exceedingly, and the predominance of one or the other phosphate gives peculiar characters; an abundance of triple phosphate presents a crystalline texture, while that of phosphate of lime exhibits an amorphous earthy appearance. Mixed phosphates are more commonly deposited on foreign bodies introduced into the bladder; encrusting them with white friable calculus masses. *Tests*:—Not combustible, and not destroyed by heat; soluble with hydrochloric acid, but does *not* effervesce either *before* or *after* heating; solution in acid, with excess of ammonia gives a white, partly crystalline, partly amorphous, precipitate; without addition easily *fusible* before the blow-pipe.

(13) *Silicious calculus.*—As a separate concretion this calculus has not been met with; but silica has been found in other calculi by Berzelius, Vauquelin, Fourcroy, and Venables. *Tests*:—Silica is negative with regard to all the tests for other concretions; it is *not* acted on, by heat, acids, or alkalies.

The relations of *all* these Calculi to *Tests*, as already stated with reference to the several forms of Calculi, and moreover, the additional tests pertaining to *each*, are conveniently shown in the following tabular view of General and Special Tests for Urinary Calculi; which represents also the order of chemical examination. It is enlarged, from the well-known Lectures of Dr. Bence Jones on Animal Chemistry.

The *appliances* requisite for the *examination* of Calculi are few and simple; a platinum spoon or piece of platinum foil, a spirit-lamp, and sometimes the aid of a blow-pipe; test-tubes and watch-glasses, with the acids,—nitric and hydrochloric, and the alkalies,—carbonate of potash and oxalate of ammonia. Certain special reagents will be noticed in the table.

The *order of procedure* is, first to test a bit of the calculus in powder, by *heat*, and thus refer it to one of the two divisions; calculi combustible, and destroyed by heat, leaving only a very little residue; or, calculi non-combustible, and not destroyed by heat, leaving a considerable residue. In the former case, the original powder is to be tested for uric acid, urate of ammonia, uric-oxide, or cystic-oxide; in the latter case, it is to be tested for (carbonate of lime), oxalate of lime, ammoniaco-magnesian, or triple, phosphate, phosphate of lime, or mixed phosphates. Next, the *mineral acid* test is to be applied; if a combustible calculus, dilute nitric acid should be used; if a non-combustible calculus, dilute hydrochloric acid is preferable. Then, the *alkaline* test must be applied. Lastly, the *special tests* may be resorted to.

*Causes of Urinary Calculi.*—The urinary formation of calculi has already been adverted to. But certain *predisposing* causes seem to have a tendency to the production of stone.

## Table for Examining Urinary Calculi.

1. By Heat.	2. By Acids.	3. By Alkalies.	Nature of the Calculus.	Special Tests.
Destroyed by Heat.	{ With nitric acid, red.    }	{ Soluble in carbonate of potash, evolving no ammonia. }	Uric acid.	{ Solution in caustic ammonia or potash, on the addition of an excess of acid, crystallizes in angular crystals. Not soluble in water. }
		{ Soluble in carbonate of potash, evolving ammonia. }	Urate of ammonia.	{ Soluble in water, when boiled. Solution in water, with a few drops of ammonia, evaporated, crystallizes in needles—microscopic. }
		{ Soluble in ammonia, not crystallizing when evaporated. }	Uric or xanthic oxide.	{ Insoluble in carbonate of potash; dissolves without effervescing in nitric acid, leaving a lemon-coloured residue; soluble in strong sulphuric acid, not precipitated by dilution. }
		{ Soluble in ammonia, crystallizing when evaporated. }	Cystic oxide or cystine.	{ Soluble in strong caustic potash; the solution, boiled for a few moments, on the addition of a drop of dilute acetate of lead, gives sulphuret of lead. }
		{ Soluble in ammonia with difficulty, not crystallizing. }	Fibrin.	{ With nitric acid becomes directly yellow. Solution in caustic potash precipitable by acetic acid in amorphous form. }
Not destroyed by heat.	{ With hydrochloric acid soluble; before heating effervesces. }	{ Solution in acid, when neutralized, gives a precipitate with carbonated alkalies and oxalate of ammonia. }	Carbonate of lime.	Soluble in dilute acetic acid, with effervescence.
		{ Solution in acid, when neutralized, gives a precipitate with carbonated alkalies and oxalate of ammonia. }	Oxalate of lime.	{ Insoluble in acetic acid. Boiled with carbonate of soda, oxalate of soda is dissolved, precipitated by chloride of calcium. }
		{ Solution in acid, with excess of ammonia, gives a crystalline precipitate. }	Phosphate of ammonia and magnesia.	{ With half its bulk of phosphate of lime (bone-earth), is very fusible before the blow-pipe. }
(Not destroyed by heat.)	{ (With hydrochloric acid soluble; does not effervesce before or after heating.) }	{ Solution in acid, with excess of ammonia, gives an amorphous precipitate. }	Phosphate of lime.	{ With twice its bulk of phosphate of ammonia and magnesia, is very fusible before the blow-pipe. }
—	—	{ Solution in acid, with excess of ammonia, gives a white, partly crystalline, partly amorphous precipitate. }	Mixed phosphates.	Without addition, easily fusible before the blow-pipe.
Not acted on.	Not acted on.	Not acted on.	Silica.	{ Fused with twice its bulk of carbonate of soda, forms glass, soluble in water, precipitable by hydrochloric acid. }



*Climate and Locality* have apparently some predisposing influence. Calculus is more common in temperate than in warm and cold regions, and more especially in humid countries of moderate and changeable temperature, such as Holland, France, Germany, and England. It occurs, however, very frequently in Egypt, Isle of France, Russia, Bagdad, and both the East and West Indies. Some parts of the same country are certainly more prone to calculus-production than other parts; as particularly the county of Norfolk in this country. *Race*, it is said, has different proclivities; that calculous disorders are more common among white than dark races of men, yet stone is of very frequent occurrence among the natives of India.

*Hereditary* transmission is evinced in the gouty diathesis, and the production of lithic acid calculi.

*Sex* undoubtedly affects the relative proportion; stone is less frequent in females than males, in the proportion of 1 to 20, or 1 to 23. This remarkable disproportion is attributed mainly to the peculiar anatomical disposition of the female urethra; its comparative shortness, larger size, dilatability, and straight course, all these circumstances facilitating the passage of a small stone.

*Period of life or Age.*—Stone may occur at any age, and according to Stahl and Geyer, it occasionally exists as an intra-uterine affection. But the two extremes of life seem to be most subject; stone being met with most frequently, it is said, in young and in old people. Of 5376 cases collected by Civiale; 1946 occurred before the age of 10 years, 943 from 10 to 20, 460 from 20 to 30, 330 from 30 to 40, 391 from 40 to 50, 513 from 50 to 60, 577 from 60 to 70, 199 from 70 to 80, and 17 after 80 years of age. Coulson has collected 3264 cases of lithotomy; under 20 years of age, the proportion was 71·20 per cent.; between 21 and 40 years, 12·10 per cent.; between 41 and 60, 10·87 per cent.; and between 61 and 80, 5·72 per cent. Sir H. Thompson's table comprises 1827 cases; under 20 years of age, 60·42 per cent.; between 21 and 40, 10·18 per cent.; between 41 and 60, 17·56 per cent.; and between 61 and 81, 11·83 per cent. Respecting the value of these statistics, Mr. Coulson has well remarked, that they represent the absolute number of persons affected with stone, at different ages; but not as relative to the total number of persons living at the several periods of life. Thus, if all persons under 20 years were affected with a certain disease, and all persons over 70 years were affected with the same disease; the liability would be the same, although the absolute number of persons attacked would be very different. By correcting this error between absolute and relative numbers, the tables would show that children and young persons are less liable to calculous disorders than is commonly supposed; that from 20 years upwards, the tendency goes on increasing in a very remarkable manner to the end of life. Sir H. Thompson thus expresses it; "that the proportion of elderly calculous patients to the existing population at their own ages, is larger than the proportion of children affected is to the number of existing children."

*Habits of life* have unquestionably some causative tendency. Thus, sedentary habits diminish the perspiratory secretion, and throw increased work on the kidneys; high living and especially indulgence in various kinds of nitrogenized food, and certain beverages, supply the material for uric acid and other allied concretions; while indigestion and secondary mal-assimilation in the textures, generate uric acid. All this pathology

of Urinary Deposits, is fully considered in my Treatise on the "Irritable Bladder."

Various morbid conditions of the *urinary organs* may induce calculous formations; the presence of a foreign body especially, which solicits the precipitation and deposition of the urinary constituents around itself as a nucleus.

Other accredited causes are doubtful. Thus, the imputed influence of certain mineral waters is fallacious, none of the forms of calculi corresponding to the salts in such waters. The alleged exemption of persons in certain occupations, as soldiers and sailors, seems very doubtful.

**RENAL CALCULUS.**—A stone forming in the pelvis of the kidney may, or may not, be attended with pain or other symptoms of nephritic irritation. Frequently it remains quiescent and unsuspected when lodged in this dilated portion of the ureter. It may there attain a large size and remarkably irregular shape, being moulded to the pelvis and calices of the ureter within the hilus of the kidney. Absorption of the kidney-substance results from the continued pressure, and this is attended with pain in the lumbar region and symptoms of nephritis. In rare cases, abscess has been known to ensue and the stone discharged through an aperture in the loin.

A *small* stone in the pelvis of the kidney usually descends through the ureter into the bladder; it gradually increases in size, as a vesical calculus, by accumulating concretion on its surface.

The *descent* or passage of a renal calculus is accompanied with more or less severe pain and constitutional disturbance, in proportion to the size and shape of the stone. A small, smooth stone, may descend without occasioning any notable suffering. A larger-sized, and rough stone, as a mulberry calculus, descends with much difficulty and causes proportionate agony. After perhaps some symptoms of nephritic irritation, the patient is seized with sudden and excruciating pain in the loin, extending down the course of the spermatic cord to the testicle,—which is often retracted, and down the thighs. This agony may, as it is said, "double the patient up," and make him roll on the ground, vainly seeking and imploring relief. It is worse to bear, and to witness, than the pain in passing a gall-stone. Bloody-urine, vesical irritability and frequent micturition, with vomiting and constitutional irritation, are the additional symptoms of a descending renal calculus, and which simulate acute nephritis. But the constitutional disturbance is not febrile, the pulse remaining comparatively unaffected. These symptoms continue, with occasional remissions, from generally, twelve to twenty-four hours,—the usual period occupied by the descent of a renal calculus; when, on its entering the bladder, all the symptoms suddenly cease. This origin, course and character, and termination of the symptoms, determine the diagnosis. Sometimes, the calculus remains impacted in the ureter, and symptoms of calculous pyelitis supervene. When the stone has become vesical, and is lodged in the bladder; the symptoms of stone in the bladder ensue.

**Treatment.**—Only palliative measures are available. Opium is the most efficacious anodyne for assuaging the nephralgic pain, and the patient can be kept under its influence during the whole period of passing the stone. Chloroform may, however, be administered with advantage, from time to time as a relaxant. The warm bath is also a most serviceable adjunct. Cupping in the loins, followed by warm fomentations, may afford some relief. The bowels should be thoroughly emptied by mild oleaginous enemata,—and diluent drinks freely allowed.

STONE IN THE BLADDER.—*Symptoms*.—A stone, *loose* in the cavity of the bladder, falls into the most dependent part, behind the prostate; but it shifts about according to the varying posture of the patient. The symptoms produced, arise from the mechanical irritation and the obstruction caused by the stone as a foreign body in the bladder. They are always essentially the same in kind, though modified in degree in different cases, and may be comprised under four heads; pain, chiefly in the glans penis; irritability of the bladder with increased frequency of micturition; obstruction occasionally to the passage of urine; and morbid conditions of the urine, bloody urine in particular. In addition to these four symptoms, which severally may arise from other causes than stone; there is the physical sign of a hard body elicited by *sounding* the bladder with a metallic instrument, whereby a stone can be felt and heard when struck,—the sensation and sound as of stone being transmitted through a metallic instrument to the hand and ear. This touchstone, as to the presence of a calculus, is conclusive, when available; and it alone is far more diagnostic of stone than all the mere functional symptoms of its presence.

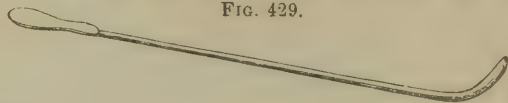
Taking these symptoms in the order mentioned, their respective characters must be noticed more particularly. The *pain* is that of a dull weight about the neck of the bladder, and perhaps an uneasy sensation extending to the lower part of the abdomen, the perineum, or thighs, or even to more remote parts, as the knee, heel, foot, or arm; but the pain shoots along the penis and centres in the *glans*. Here the pain is more acute, and it is aggravated *after* each act of micturition, when the stone settles down on the more sensitive trigone vesicale of the bladder behind the prostate. In consequence of this pain in the glans penis, children acquire the habit of constantly handling and pulling the prepuce, whereby it becomes conspicuously enlarged and elongated; the recumbent position also is often sought instinctively in passing water, to relieve the recurring attack of suffering. The *vesical irritability* and frequent desire to evacuate the bladder, are in like manner aggravated *after* micturition; for as the urine is strained off by an urgent effort, the stone settles down on its sensitive bed. Thence micturition is not unfrequently spasmodic and involuntary. The semen may be ejected at the same time, and sometimes with troublesome priapism; and there is a tendency to prolapsus of the rectum, in consequence of the oft repeated straining and spasmodic efforts to relieve the bladder. When the bladder is empty, any movement of the body will be more or less communicated to the stone, which rolls about with every change of posture. Personal experience soon restrains the sufferer's movements. Exercise is avoided, and he shuns any sudden or violent exertion; the pain is increased also by any jolting motion, as in jumping, riding, or driving. The *urine*, passed frequently and in small quantities at a time, may flow freely, in a full stream; but it is ever liable to *stop abruptly*, owing to the stone being washed forward suddenly against the neck of the bladder, thus closing the urethral orifice. The *character* of the urine changes. It becomes clouded and sometimes loaded with mucous or muco-purulent deposit, which may clear off as the bladder gets reconciled to the presence of a stone. But it is more often and characteristically tinged or streaked with blood, sometimes amounting to vesical hæmorrhage; and this symptom may continue for a long period. *After* micturition or any rough exercise, bloody urine is more apt to occur, from attrition of the stone and interior of the bladder.

*Sounding the Bladder*.—A *sound* is a solid steel instrument, shaped



like a catheter; but with a shorter curve, and having a bulbous extremity and a broad, flat smooth handle (Fig. 429). It should be smaller than a full-sized catheter, this reduction and its shorter curve enabling the instrument to be freely turned about in the bladder; while its somewhat enlarged extremity may aid in detecting the stone, and its expanded

FIG. 429.



handle render the sensation communicated more perceptible to the touch. A proportionately smaller instrument, and with an abrupt curve, will be suitable for children, in whom the bladder is situated higher up in the pelvis than in adults. Sounds of various sizes and curvature will be required for different cases.

FIG. 430.



Sounding is performed in the following manner:—The bladder containing three or four ounces of urine, or having been distended to that amount by injection with warm water, and the patient lying in the semi-recumbent position; the instrument is warmed, conveniently by slipping it up the arm of the operator for a few seconds, then well oiled, and passed gently along the urethra into the bladder. (Fig. 430.) Its cavity is explored, first along the inferior surface by raising the handle of the sound and passing its convexity from the neck of the bladder in a sweep backwards; then, the bladder should be explored laterally, by revolving the handle from side to side between the fingers and thumb; lastly, the instrument should be withdrawn to the neck of the bladder, and the point turned downwards to the depressed space behind the prostate, and then upwards to behind the pubes. The space behind the prostate may sometimes be advantageously tilted forwards by introducing the finger into the rectum; a proceeding chiefly requisite in old persons.

In all these manœuvres, the instrument is used with a gently tapping motion, in order to strike the stone. Failing to discover a stone in the recumbent position, the bladder should be sounded with the patient standing up, and with a more or less than moderately distended state of the cavity. These resources having failed to present the stone, a second exploration may be made in the course of a few days.

The knowledge gained by sounding comprises more than the fact of the presence of a stone. Its *situation* is generally found to be on one side of the neck of the bladder, more frequently to the right; or when small sized, it usually lies backwards towards the fundus or buried in the space behind the prostate. (See Fig. 430.) Its *size* is less clearly ascertainable, but this may be guessed by observing the extent of hard surface over which the sound passes and the readiness with which the stone is found in all conditions of the bladder. By introducing a lithotrite, the dimensions of the calculus can be measured in all directions, as indicated by the separation of the blades. The *shape* of the *surface*,—whether rough or

smooth, is tolerably perceptible to the touch ; and the *density* or hardness of the stone can be estimated almost precisely by the sound elicited on percussion with the instrument—by, in fact, *sounding*. A hard calculus, as the oxalate of lime or uric acid calculus, rings when struck, so as to communicate a click audible to a bystander at perhaps a distance of some yards off ; a soft calculus, consisting of phosphates conveys a dull earthy sound, perhaps scarcely audible to the operator. The grating rough sensation and slight sound of a fasciculated bladder, perhaps overlaid with phosphatic deposit, must not be mistaken for a distinct calculus.

A second calculus, or the presence of several calculi, can sometimes be distinctly detected by the sound, a stone perhaps lying on each side of the bladder ; the introduction of a lithotrite will, however, surely determine the question, when one stone is seized and another struck with the instrument still holding the first in its grasp. Sir H. Thompson has devised and employed a modification of the lithotrite, which acts as a sound, catheter, and measurer. It goes by the name of Weiss's catheter-scoop with stop-cock.

Sounding is an operation not wholly free from danger. It may induce cystitis and peritonitis, terminating fatally. Sanson, Civiale, Crosse, and others have recorded such fatal cases. Hence, caution and gentleness should be observed in the practice of this familiar procedure. With all possible light-handedness in sounding, severe cystitis is sometimes provoked ; as happened in a case where Dr. Gross had sounded a young man, who was, however, the subject of stone of twenty years' duration, and accompanied with chronic cystitis.

All the symptoms of stone are more or less *pronounced* according to the size and shape of the calculus, as a foreign body in the bladder. A large-sized stone is usually attended with more marked symptoms ; and an irregular, rough stone is productive of the most severe symptoms. The kind of calculus has some influence, but chiefly as depending on the constitutional diathesis. Phosphatic calculi imply also a disorganized state of the bladder or chronic cystitis, and thence the accompanying local and constitutional disturbance of this state. On the other hand, sounding may *fail* to discover the presence of stone, and such instances have occurred in the hands of the most experienced Surgeons ; as Cheselden, Pelletan, and Dupuytren. In some cases, *large* calculi, of the size even of a hen's or duck's egg, nearly filling the bladder, have escaped the most careful and minute examination ; instances of which are related by Verzascha, Benevoli, Duretus, Riverius, Marcellus Donatus, Chesneau, Valentin, Riolanus, Morgagni, Covillard, Tolet, Morand, Deschamps, and Chopart, and by Gross as having occurred in the practice of Sir B. Brodie. *Several* calculi cannot always be detected : Collot extracted from the bladder twenty-two previously undiscovered calculi, which were hard and the size of a hazel-nut. Failure has occurred also after *repeated* exploration, as in the hands of Abernethy, who thus failed to discover a large, rough, oval calculus. In some such cases, the stone has remained undiscovered for years, until *after death*. An instance of this kind I remember to have heard from the late Mr. Thomas Morton (Surgeon to University College Hospital) as having happened in his own practice ; an instrument had been constantly passed also by many eminent Surgeons during a period of fifteen years, and yet no stone was found until after death. In other cases, and not unfrequently, a stone may be distinctly felt at one time, and not at another ; a remarkable instance of which fell to my own lot. I had

distinctly touched a small stone, lodged apparently in the cul-de-sac behind the prostate, and it was also felt by other Surgeons; yet, a few days afterwards, when about to operate, I could not detect the stone as the patient lay on the table, nor could it be discovered by Mr. Coulson Senr., or by Mr. Gutteridge; the latter skilled lithotomist having explored the bladder in various states of distension and the patient standing up. In about a month afterwards, the patient came to me with the stone in his hand; he told me that he had been seized with an intolerable desire to pass water, and as if the passage would burst, when the stone suddenly shot out and rolled across the room. Lastly, a calculus may be found *apparently*, by sounding; and then the unhappy mistake has been made, of cutting for stone and finding none. This misadventure has, however, happened to the most experienced Surgeons; to Cheselden, who on three occasions cut and found no stone, Crosse also, Roux, and Dupuytren, each of whom have thus performed abortive operations. Velpeau was acquainted with four such instances, and S. Cooper knew of seven.

*Encysted* calculus is so named when the stone is lodged in a cyst or pouch of the mucous membrane, between the muscular fasciculi of the bladder. The symptoms of stone—as caused by a loose, hard body rolling about in the bladder, are necessarily *absent*. There may be some pain and weight, with increased frequency of micturition, arising from the irritation of a foreign body; but there cannot be any aggravation of these symptoms after each act of micturition, and much increased by any jolting exercise—the stone being stationary; nor any sudden stoppage of the stream of urine, and constant liability to the admixture of blood. Then again, sounding gives less positive evidence as to the presence of a stone. The encysted condition may be suspected; if the stone be struck just once in a way,—when its exposed surface is hit by chance, and if it be always found at the same part of the bladder; or if the stone can sometimes be easily felt and at other times not felt at all,—owing to its escape occasionally into the bladder and back again into the cyst. A large encysted calculus having been struck, may perhaps be defined with the bulb of the instrument; not as an isolated stone, but through the mucous membrane as a projecting tumour. This comparative absence of symptoms occurs also when a calculus, at first loose in the bladder, *afterwards* becomes encysted.

*Diagnosis.*—The symptoms of stone, taken severally, may, when *present*, be due to other diseases of the bladder. A pedunculated growth in the bladder may, during micturition, flap over the urethral orifice and thus abruptly arrest the flow of urine. Ulceration of the prostate, or malignant disease of the bladder, both give rise to hæmorrhage. Lastly, the pain and vesical irritability may be sympathetic of an impacted and inflamed testicle within the inguinal canal, in the more rare case of undescended testis. We should therefore not be misled by the presence of any one symptom, but be guided by an *association* of the symptoms in respect to urinary calculus, as in the diagnosis of nearly all other diseases. Even the positive evidence afforded by sounding will often be masked when the prostate is enlarged. And, as Sir B. Brodie first observed, the last mentioned symptoms, pain and vesical irritability, are often much diminished by this prostatic condition; owing probably to the enlargement protecting the more sensitive neck of the bladder from the weight and friction of the stone. Difficulties, and sources of fallacy, in the way of sounding may be thus enumerated; a large and deformed bladder; a



contracted bladder, unable to contain fluid; a sacculated or encysted bladder; an irregular hour-glass contraction of the bladder, obstructing the passage of the sound into one of the compartments; calcareous matter adherent to the walls of the bladder; calculi in the prostate and urethra; enlarged and roughened prostate; and tumours at the neck of the bladder. The calculus itself may be coated with blood or mucus.

In the *female*, the symptoms of stone are similar to those in the male. Sounding is very easily accomplished, the straight and short urethra readily admitting the instrument and exploration of the bladder. The sound should, therefore, be shorter and less curved. By introducing the fingers into the vagina, the stone can be tilted forward, thus facilitating the examination.

*Consequences, and Terminations of Stone in the Bladder.*—The bladder, prostate, ureters and kidneys, undergo important structural changes, chiefly of a destructive character. With these changes in the urinary apparatus, exhaustive constitutional disturbance takes place. The bladder becoming extremely sensitive, especially behind the prostate where the calculus commonly rests, the urine is expelled at short intervals, and a contracted state of the bladder ensues. Sometimes, however, it falls into an atonic and dilated condition, with retention of urine, which undergoing decomposition assumes an ammoniacal and offensive character. In either state, more particularly the latter, chronic cystitis frequently supervenes, subject occasionally to attacks of acute cystitis; with muco-purulent urine. A fasciculated condition of the interior of the bladder usually results, in consequence of an hypertrophied development of the muscular bands beneath the mucous membrane; and not unfrequently between these fasciculi a hernial protrusion of the mucous membrane occurs, forming a pouch or cyst, in which the calculus is apt to lodge, as an encysted calculus. An ulcerative and discoloured sloughy state of the mucous membrane sometimes sets in; or a parietal abscess may form, which opening into the bladder, may receive the stone into its sac, and thus the calculus becomes encysted. Perforation of the bladder has been known to occur, allowing the stone to escape into the peritoneum, or perhaps into the rectum, vagina, or perineum. Pelvic cellulitis sometimes occurs, with diffuse suppuration. These more extreme results have probably been induced by injudicious sounding. The *prostate* usually becomes in some degree enlarged, whereby a depression or pouch forms behind it, as a frequent receptacle for the stone. The *ureters* undergo less marked changes; generally they are somewhat dilated, and thickened by chronic inflammation, especially at the pelvic portion adjoining the kidney. This organ is the seat of the most serious and ultimately fatal disorganization. Thus, the *kidneys* may be affected with chronic nephritis; and sometimes with the acute form of this disease, terminating in suppuration and a speedily fatal issue by uræmia or pyæmia. Degeneration more commonly takes place as the consequence of chronic nephritis, and thence death ensues from albuminuria.

This, the ordinary course of stone in the bladder extends over a longer or shorter period of years: varying very much according to the kind of calculus, the constitution, and age of the patient. Nevertheless, the course, although more or less slow and the symptoms more or less severe, is always progressive in its tendency to a fatal issue. As a set-off to this mode of termination, a spontaneous cure now and then takes place, by the expulsion of a small stone through the urethra in the act of straining micturi-

tion; and far more rarely, ejection of the stone has occurred by ulceration of the bladder through the rectum, vagina, or perineum.

*Treatment.*—The *remedial*, as well as the *preventive*, treatment of vesical calculous affections, comprises those general measures—medicinal and hygienic—which have reference to the calculous diathesis, in each particular kind of urinary deposit; and also, the various morbid conditions of the urinary organs, resulting from the presence of calculus as a foreign body; chiefly irritability of the bladder, cystitis and nephritis. The former, or specially constitutional treatment, is considered in the “Practical View of Urinary Pathology” to which I have already alluded; while, the inflammatory conditions of the bladder and kidneys are treated, the one under Diseases of the Bladder in this work, the other in works on the Practice of Medicine.

*Operations.*—The treatment of Stone in the Bladder consists of the various *operative* procedures appropriate for the removal of Stone. Three methods have been devised, two of which are established Operations; (1) lithotomy or the extraction of stone by a cutting operation; (2) the removal of stone mechanically by instruments, without a cutting operation—as by lithotrity or crushing in the bladder and extraction piecemeal through the urethra, or sometimes by simple dilatation of the urethra; (3) solution of Stone, by chemical agents or “lithontriptics,” or by the agency of electricity—“electrolysis.” Having regard to the desirability of these several methods of procedure, it might seem proper to notice the latter, or removal by solution, first; but in consideration of the far superior efficacy of the other two methods, they will be described almost exclusively; and first lithotomy, as being the operation perhaps most generally applicable.

LITHOTOMY, or the operation of cutting for Stone in the bladder, has been performed in various ways; both as with regard to the seat of operation and the method of its performance. There are three situations in which the bladder may be entered—in the perineum, the supra-pubic or hypogastric region, and through the rectum; thus indicating three principal operations of lithotomy—perineal lithotomy, the supra-pubic or high operation, and the recto-vesical operation. Perineal lithotomy comprises four varieties; (1) the ordinary *lateral* operation of Cheselden, and as modified in detail by Key, Liston, and other modern lithotomists; (2) the *median* or Marian operation, revived by Vacca, and as modified by Civiale, Buchanan, and established in modern surgery by Allarton; (3) the *bilateral* or transverse operation of Dupuytren; (4) the *quadri-lateral* section of the prostate by Vidal de Cassis.

No branch of Surgery possesses a history more interesting, curious, and romantic, than that of lithotomy, and its comparatively recent substitute—lithotrity; and nowhere is the temptation so alluring to an author in love with his Profession, to trace the gradual development of surgical principles and their application in practice. Nor would such an history be out of place in a work embracing the *Science* conjoined with the Practice of Surgery. But the necessary allotment of space forbids that which would be a somewhat lengthened diversion.

*Preparation of the Patient for Lithotomy.*—Some Surgeons, as Key, have paid great attention to the state of the patient's constitutional health preparatory to operation; other Surgeons of equal eminence, as Liston, have not deemed it necessary to delay the operation by much preparation. The nervous system being tranquil, or subdued by an occasional

opiate, the skin acting freely, and the urinary secretion having been corrected, as far as possible, by alkalis or acids, according to the character of the calculus; the bowels should be well relieved by mild purgatives, and the rectum especially must be emptied by an enema of castor oil and gruel on the morning of the operation. On no account should the operation be performed until the enema has come away, the loaded state of the bowel much increasing the liability of wounding this part.

*Instruments.*—Certain arrangements, which although simple, are indispensable to the safe performance of lithotomy. A firm, even, operating table, lightly covered with a doubled blanket so as not to present any thickness into which the buttocks might sink unevenly; a piece of waterproof covering being placed over the blanket, of sufficient length to hang down over the end of the table. Pillows are requisite to support the back. A firm stool is the most convenient seat, and it must be of such height relative to the table, that the patient's buttocks shall be level with the operator's breast when he sits down. This adjustment is easily made by experience. A small low table or a large chair should be provided, on which the instruments are laid out; and placed to the right of the operator, so that he can readily help himself during the operation, independently of any assistant for this purpose. The appliances and instruments requisite are;—a pair of bandages of coarse flannel, each about three yards long and two inches in width; two lithotomy knives or scalpels; namely, a sharp-pointed, straight-backed knife, and a blunt button-pointed knife, somewhat curved backwards towards the end; a staff, boldly curved and deeply grooved on its left side with a good pit at the end of the groove, the size of the instrument being sufficient to fill the urethra, and the handle roughened; lithotomy forceps, straight and curved; scoops of different sizes; a bladder-searcher; and an injecting syringe, capable of holding about a pint, the nozzle fitting to a catheter. To these may be added, a gum-elastic urine-draining tube with rings at its outer end, whereby it can be fixed in the bladder with perineal tapes, after the operation. This instrument was invariably used by Liston, and subsequently by Sir W. Ferguson in the earlier portion of his career; it has also been employed by other excellent lithotomists, and as a Listonian pupil, I naturally followed for a time the example of the great master. But the tube was, I believe, never used by Coulson, nor by other men of large experience, and it has now fallen into general disuse.

*Lateral Operation.*—Four assistants at least are required for the performance of this operation; one to administer chloroform, one on each side of the patient to fix the perineum in the proper position as presently described, and a fourth to take charge of the staff. A fifth assistant might be convenient to hand instruments, unless they are placed within easy reach of the operator, when sitting down.

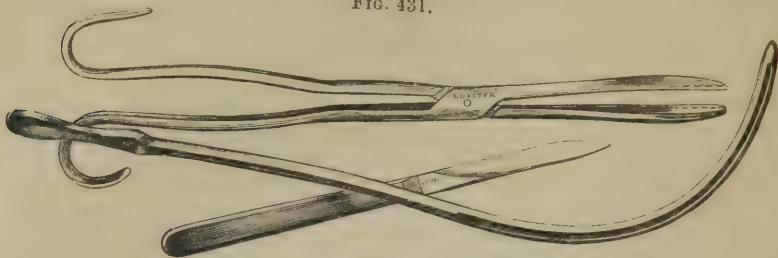
The operation consists in cutting on a staff into the bladder,—by a preliminary superficial, perineal incision to reach the instrument, followed by a deep or prostatic incision in the groove of the staff to enter the bladder; and the extraction of the stone. Thence the instruments essentially requisite, are simply three; a staff, a knife, and forceps. (Fig. 431.)

The patient is placed recumbent on the table, and chloroform administered. Then the bladder having been previously emptied of urine, should be injected with tepid water to the amount of about six ounces, in order to steady the bladder and expose the stone to the grasp of the



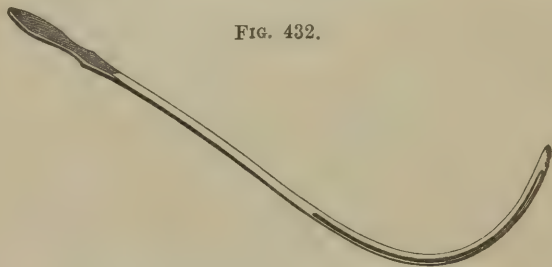
forceps. Sounding should now be performed, immediately before the operation is commenced,—when the patient's bladder is in position. This may be done with an ordinary sound; but it is preferable to at once in-

FIG. 431.



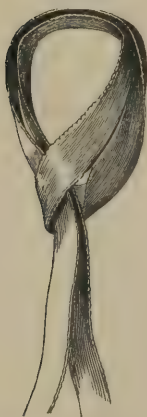
roduce the staff (Fig. 432) of sufficient size to occupy the urethra—and, using it as a sound, the stone must be distinctly felt and its situation ascertained. This is an imperative rule in regard to lithotomy. If the

FIG. 432.



stone cannot be felt at the time of operating, the operation should be unhesitatingly postponed; if it can be felt, the operation is proceeded with. The patient is brought to the end of the table, so that his buttocks

FIG. 433.



resting on the edge shall project a little beyond it; the legs are to be drawn up and the hands and ankles firmly bound together with the lithotomy bands (Fig. 433), as thus,—either hand being placed on the outer side of the ankle and made to grasp the foot, both are securely joined in this position by a figure-of-8 application of the band. Or the couplet leathern straps used by Sir W. Ferguson is a more simple, and equally secure con-

FIG. 434.

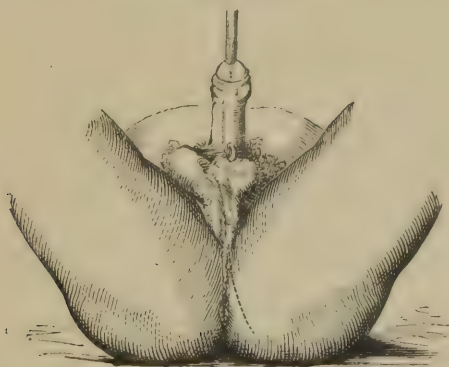


trivance. (Fig. 434.) Then, the side-assistants, taking each a foot

in his hand on the inner aspect of the foot, and placing the patient's knee in his axilla, the limbs are drawn sufficiently apart to fully expose and throw out the perineum; at the same time observing that it inclines to neither one side nor the other, but is fixed perpendicularly, or horizontally to the table, and maintained in this position throughout the operation. Unless these two assistants attend only to this, their simply mechanical but important duty, that of exposing and balancing the perineum, instead of attempting to hang over and see the operation; they will assuredly disturb the visual line of the operator and thus embarrass him in his incisions and manipulations.

The staff is now given in charge of an assistant, standing on the patient's left, with the injunction to hold it firmly, in the perpendicular direction, and hooked up against the symphysis pubis. (Fig 435.) I

FIG. 435.

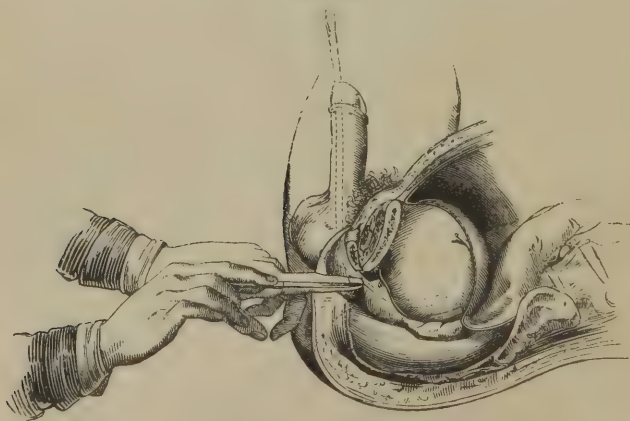


once heard Mr. Coulson request a young assistant to hook up the staff as if to the ceiling; and I thought that illustration as to the mode of holding the staff, very suggestive of the right way. Some Surgeons prefer that the convexity of the staff should be made to bulge slightly forward in the perineum; others that it should be turned somewhat towards the left of the perineum; while some prefer that it should be depressed and held in contact with the stone. The assistant holds the staff between the thumb and fingers of his right hand; the left hand is used to raise the scrotum from the raphé running down to the rectum. Thus then, the space between the urethra and the rectum is exposed as much as possible, so that the one can be more readily approached without the risk of wounding the other.

The Surgeon seating himself on the stool in front of the perineum, thus exposed; he shaves the integument on the left side, and introduces his finger into the rectum to know for certain that the bowel is empty and to induce its contraction; whereby any remaining feculent matter will be expelled, and the contracted state of the bowel diminishes the risk of its being wounded during the deeper incision. Then, with his left hand thumbing the tuberosity of the ischium and the ramus on the left side, he feels also, with the point of the fore-finger, the sort of depression below the bulb of the urethra, in the middle line or raphé, which lies over the curve of the staff; a point about one inch and a half in front of the anus, and corresponding to a part of the instrument which

in a thin perineum can often be plainly felt. The land-marks of his incision having thus been clearly defined; the Surgeon rests his left hand on the right half of the perineum and indicating with the fore-finger the above spot, he plants the lithotomy-knife in the raphé or just to the left of it, and carrying the blade in a straight line obliquely downwards and outwards between the anus and tuberosity of the ischium, but nearer to the latter, terminates the incision at a point just below the anus. A *free* but superficial *perineal* incision is thus made. (See Fig. 435.) The skin, superficial fascia and fat are divided; but the depth of the incision, varying according to the perineal obesity, is above rather less than an inch, while below, the knife sinks a little more deeply into the ischio-rectal fossa. The upper half of this incision—above the anus, leads to the staff; the lower half,—by the side of the anus and below it, facilitates the extraction of the stone. The point of the fore-finger of the left hand is now drawn firmly along the bottom of the wound, between the left erector penis and accelerator urinæ muscle overlaying the bulb of the urethra, so as to separate these parts; then, using the finger to protect the rectum, by pressing it somewhat downwards and to the right, any further resisting structures are divided by a slight touch or two with the knife. Thus are divided, the transversalis perinæi muscle and artery, and the base of the deep perineal fascia or triangular ligament of the urethra, which latter sometimes in elderly persons presents a tolerably firm bar to the finger. The finger is then directed upwards from the rectum, as a guide to the staff; the groove of the staff is felt just in front of the prostate, in the membranous portion of the urethra and as covered therefore with this membranous structure stretching across the groove. By a little compression at this spot, the nail of the finger is lodged fairly in the groove; and then the point of the knife, with the cutting-edge downwards, is slid along the finger *over* the nail, and penetrating the membranous urethra, is at once inserted into the groove of the staff. This relative position of the finger to the knife will securely protect the rectum, —itself also pressed downwards and to the right; and which, from its

FIG. 436.



proximity beneath the prostate, is especially liable to be wounded at this part of the operation,—the commencement of the *deep* or *prostatic* inci-



sion. (Fig. 436.) The knife is now pushed firmly along the groove of the staff, through the prostatic portion of the urethra and the prostate, with a slight inclination of the blade downwards and outwards; thus incising or notching the prostate *laterally*, in the same direction as the external or superficial incision; while the point of the blade by slightly depressing the handle to a very limited angle with the staff, follows the curve of the staff, until the bladder is entered. If the knife directed sideways, runs firmly in the groove of the staff, so as not to slip out to the left, the blade cannot go wrong and the incision must be right. The bladder is known to be entered by resistance ceasing, and perhaps a gush of water taking place. This incision may be made rapidly and boldly by a practised lithotomist; I have seen Liston run the knife along the groove right into its terminal pit, which the point of the blade might be heard to strike, even turning the point of the instrument. A less practised lithotomist must make the incision more slowly and cautiously. A *button-pointed* lithotomy-knife (Fig. 437) may be used more safely, as it

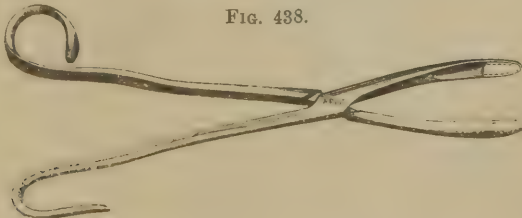
FIG. 437.



locks into and has a more secure hold in the groove of the staff. Such a knife was always employed by Coulson. In withdrawing the knife, it should pass over the finger, in the same direction as in introducing it, and still in the groove of the staff, so as not to enlarge the incision.

This—the deep or prostatic incision, is therefore essentially *limited* in its *extent* through the *prostate*; not exceeding twice the width of the blade of the knife, and certainly not passing beyond the base of the gland, where its *capsule* prevents infiltration of urine into the cellular texture of the pelvic cavity behind the prostate. This precaution is especially characteristic of the Listonian operation. On withdrawing the knife, the left fore-finger is pushed in after it through the prostatic incision into the bladder; and, if this manœuvre be executed adroitly, the introduction of the one follows the exit of the other,—the finger replacing the knife *before* the water escapes in any gush from the bladder. The finger, fitting into the incision, is made to enlarge the wound by a sort of twisting, or tunnelling motion; whereby the opening is dilated and the prostate somewhat split, as with a blunt gorget instead of having been cut freely by

FIG. 438.



the knife. As the finger proceeds, at the same time—the stone is felt for. This double duty of the finger, as a dilator and a searcher, may be conveniently performed, while the Surgeon is taking the forceps with his

other hand from an assistant, or from a basin of warm water at his side. Having thus entered the bladder, and found the stone; the assistant is directed to withdraw the staff. Then the Surgeon introducing the closed blades of the forceps over the finger, he slides them into the bladder; when, on somewhat dipping the forceps and opening the blades (Fig. 438), usually with a sort of sweep from left to right across the fundus of the bladder, the stone is at once caught and seized, whereby the instrument feels suddenly locked. The size of the stone may be estimated by observing how far the handles are separated. If it seem to be seized in its long diameter and too large for extraction; the stone may be shifted by a jerk of the forceps, or disengaged and re-seized, so as to be extracted without lacerating or bruising the neck of the bladder.

*Extraction* should be performed slowly, and by working the instrument gently backwards and forwards to gradually dilate the prostatic aperture; bearing downwards also in the direction of the axis of the pelvis, in order that the widest part of the arch of the pubes may be available for the extraction, and the lower part of the perineal incision which facilitates this concluding part of the operation. The forceps lie in the axis of the pelvis, and are withdrawn, in the same direction as obstetric forceps. After removing the stone, the finger should be re-introduced into the bladder to search for any other stone which may be present; or the *searcher* can be used for this purpose to reach parts of the bladder not readily accessible to the finger, as in front above the pubes. And, as *in* the act of withdrawing the knife through the prostatic incision, the finger at once followed it; so also *in* withdrawing the forceps, the finger is again made to follow this instrument; that thus the entrance to the bladder

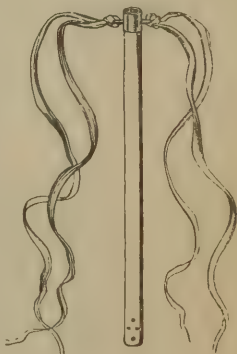
FIG. 439.



shall never be lost—an injunction the more imperative when the staff, as a guide, has been withdrawn. No second stone having been discovered, the operation is completed.

*Fracture* of the stone sometimes occurs, in seizing or in extracting it; and generally as the result of undue force in using the forceps, aided perhaps by the brittle character of the stone, as when the calculus is phosphatic. This accident should be carefully avoided; for the fragments are apt to injure the bladder in any attempt to extract them, and it necessitates the repeated introduction of an instrument. The fragments are best removed by means of the *scoop* (Fig. 439), with the fore-finger resting on the end of this instrument and keeping the stone from slipping out of the bowl. The bladder should then be thoroughly washed out with tepid water, injected by a strong brass syringe through a tube introduced by the wound. Several small calculi are most readily removed in like manner—by the scoop.

FIG. 440.



A gum-elastic tube (Fig. 440) may then be introduced through the wound into the bladder, and retained in position by perineal tapes. This instrument was formerly deemed serviceable for two purposes; as a means

of somewhat arresting any oozing hæmorrhage; and for keeping the wound free of coagula, thus affording a clear passage and preventing the infiltration of urine. But the latter risk is avoided by the limited prostatic incision; and the former advantage is more than counter-balanced, in most cases, by the incessant concentration of the patient's attention to his bladder.

I have thus described the lateral operation of lithotomy as consisting of three steps—two of which are incisions—a superficial or perineal, including a deeper touch or two with the knife, and the deep or prostatic incision; and then, extraction of the stone from the bladder. It should, however, be observed by the Student, that although these steps are described separately, they are performed successively as one continuous operation. The procedure consists in an *alternate* application of the left fore-finger and the knife, or the forceps. Commencing with the indication of the point for entering the knife in the perineum, this is followed by the superficial perineal incision; then, the finger is used successively, as a protector, guide, blunt-gorget, and searcher; with the knife alternately, in the perineal wound, the groove of the staff in the membranous urethra, the prostatic urethra, and bladder; followed by the forceps, also used alternately with the finger, in the bladder. The textures are successively divided downwards and outwards, away from the rectum, by *lateralized* incisions; and they together form an oblique *conoidal* wound, having its base externally in the perineum, and the apex in the prostate.

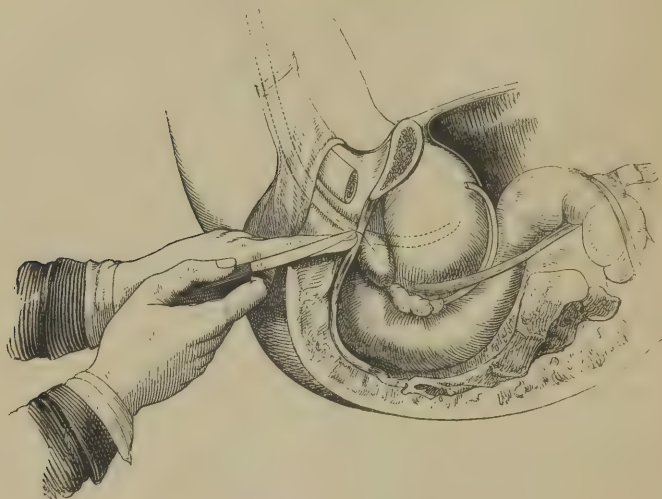
*Position of the Hand and Knife.*—Much difference of opinion has been held in surgical works of authority, and different delineations have been given, as to the manner of holding the knife in lateral lithotomy. I specially allude to this question on that account alone, and not because of its intrinsic importance. So long as the proper incisions are observed, both with regard to their situation, direction, and extent, it can be of little consequence how the knife is held in executing them. The Surgeon will best accomplish the object he has in view, in the manner most convenient to the movement of his own hand; a matter of personal experience which must necessarily vary with the shape and mobility of this member in different operators. In making the superficial or perineal incision, the knife is generally held *under* the hand; and in making the deep or prostatic incision, this position is still maintained by Sir W. Fergusson (see Fig. 436), and most other lithotomists. Liston, however, would appear to have held the knife *above* the hand, in making the latter incision, as here depicted. (Fig. 441.) This wood-cut is the identical one which originally appeared in Liston's Practical Surgery, and for the use of which (and many other wood-cuts) in this work, I am indebted to my Publishers. It is described as being a representation of "the position of the hands and knife," at the commencement of the second incision, as shown "in a very correct sketch of the viscera of the pelvis, with their relative size and position; and which has been copied more than once without acknowledgment." (Fourth Edition, 1846, p. 509.) But, notwithstanding this record by Mr. Liston, on the point in question; as an old Hospital pupil, having enjoyed unusual and prolonged opportunities of witnessing the operations of the great lithotomist, I can corroborate the statements of Sir W. Fergusson, Mr. Erichsen, and Mr. Cadge of Norwich, that Mr. Liston held the knife *under*-hand; and I particularly well remember also that, in entering the point of the knife into the groove of the staff, his fingers were enclosed around the blade, apparently to



cover the edge, and fit the point into the groove securely—the instrument being then sent forward from the palm of the hand.

*Cutting on a Straight Staff.*—This mode of performing the lateral operation was originated by Aston Key, at Guy's Hospital, where it is still practised, and by other Surgeons. The straight staff is more liable to be tilted out of the bladder than the curved one; and therefore, the

FIG. 441.



end of the staff should always rest upon the stone in performing the operation with this instrument.

Having reached the staff by the perineal incision, which has to be carried deeper than to reach the curve of the ordinary staff, the point of the knife is entered into the groove; then the Surgeon, withdrawing the left fore-finger from the wound, takes the staff from the assistant previously in charge, and depressing the handle brings it down parallel with the axis of the pelvis, so as to present a direct passage to the bladder. In doing either of these acts, special care must be taken lest the knife slip out of the groove. Feeling certain that it still remains in; the Surgeon lateralizes both staff and knife, in contact, to the left of the perineum, corresponding to the external incision, and pushes the knife onwards along the groove into the bladder; withdrawing it in the same direction, so as to incise the prostate only to a limited extent. Here again, in this nearly parallel mode of using the staff and knife, special caution must be taken lest the point be tilted out of the groove by the front of the prostate; when, instead of entering the bladder, it would pass down into the pelvic cavity. This may be obviated by depressing the handle of the knife to a *limited* angle with the staff, so as not to incise the prostate too far back. Then, having entered the bladder and withdrawn the knife, this instrument is laid aside; the staff is now transferred to the right hand, and the left fore-finger, introduced into the wound, is guided by the staff into the bladder and to the stone. The finger resting on the stone, the staff may

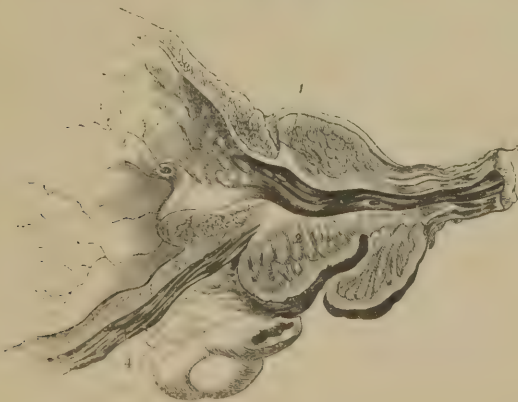
be withdrawn; the forceps is introduced along the finger, and the operation completed.

*Parts cut, and Parts to be avoided, in Lateral Lithotomy.*—If the operation be conducted on the principles laid down, the question of the “parts” concerned, is more an anatomical investigation than a surgical consideration—more a Student’s question, than of practical consequence. The parts necessarily *divided*, in their order from without inwards, are;—the skin, superficial fascia and fat, with the inferior hæmorrhoidal vessels and nerves passing across the ischio-rectal fossa; the transverse perineal muscle and artery, with probably the superficial perineal artery and nerves; the base of the triangular ligament and the deep transverse urethral muscle; the membranous urethra and constrictor muscle; the prostatic urethra, and the prostate to a limited extent in its left lateral lobe, including the “ligamentous ring or band” around the neck of the bladder, but not the capsular boundary formed by the reflexion of the recto-vesical portion of the pelvic fascia; external to the capsule, some of the anterior fibres of the levator ani muscle will be divided, and within the capsule, a plexus of rather large-sized veins must be severed—in the prostatic incision.

The annexed figure (Fig. 442) represents the “parts cut in Lithotomy,” as depicted in Liston’s Practical Surgery.

In addition to the vessels necessarily divided, certain vascular *deviations* occasionally from the normal arrangement render other vessels liable to be wounded. Thus, the artery of the bulb, when it arises from the pudic near the tuber ischii, crosses the line of incision. The accessory pudic, as an occasional substitute for the pudic when defective, lies on the posterior edge of the prostate, and would be divided by the prostatic incision, if this were extended backwards to the base of the gland. Arterial branches, or the venous plexus, on the surface of the prostate, are each

FIG. 442.\*



sometimes unduly enlarged, and become a source of hæmorrhage, arterial or venous.

\* 1 and 2, fibrous band around the orifice of the bladder; 3, opening of ureter; 4, descending muscular fibres, with transverse fibres towards the cavity. (John Marshall.)

The parts to be *avoided* in the operation, are in anatomical works enumerated;—as the rectum, the pudic artery, where it courses forwards under cover of the ramus of the pubes; the bulb of the urethra; and the artery of the bulb, which normally passes inwards transversely about half an inch above the base of the triangular ligament, between it and the other or deep layer of the perineal fascia. Of these parts, the rectum will be avoided, by having the staff well hooked up, protecting the bowel with the finger and lateralizing the knife parallel with the bowel—particularly in an old person whose rectum is commonly dilated into a pouch just above the anus, sometimes even wrapping around the prostate from side to side. The precaution of emptying the bowel should also be observed. The other parts mentioned are less readily wounded, or are less important. The pudic artery will be avoided by not turning the knife too much outwards in making the deep incision. Posteriorly this artery is securely lodged under cover of the tuber ischi. The artery of the bulb, sometimes a serious source of hæmorrhage, may be avoided by not cutting too freely upwards towards the groove of the staff; but an irregular course of the vessel cannot be foreseen or avoided by any plan of incision. Lastly, the bulb of the urethra, a source of venous hæmorrhage, may be avoided by directing the point of the knife obliquely upwards beneath its projection, in the act of penetrating the membranous urethra. But, I concur with Mr. Skey, in not attaching much importance to a wound of the bulb; and I have no doubt it not unfrequently occurs without any evil consequence.

As compared with these anatomical niceties, it will be found that while anatomy plans the landmarks and limits of the incisions—perineal and prostatic; the *pathological* conditions of the prostate and of the bladder are of more surgical importance in completing the operation.

*The Lateral Operation in Children.*—Lateral lithotomy is performed in the same way in Children as in Adults; but the anatomical condition of the parts under the age of puberty and especially in childhood, affects the performance of this operation. The anatomical peculiarities alluded to are chiefly four;—looseness of the perineal cellular texture in the recto-vesical space; the small size, thinness and weakness of the membranous urethra; the rudimentary small size of the prostate; and the position of the bladder—it being situated more in the abdomen than in the pelvis. These conditions severally affect the operation in its first part—that of entering the bladder; extraction of the stone is not attended with any special difficulty.

Thus, the superficial perineal incision having been made correctly, the *loose cellular texture* easily yields and gives way under the finger, forming a distinct, smooth-walled cavity or false-bladder, in the recto-vesical space; which resembles the interior of the bladder. A very little groping with the finger, in the wrong direction—*downwards* will form this deceptive cavity; into which the finger readily enters as if into the bladder. Perhaps also the membranous urethra has been penetrated, whereby the urine dribbles away and the bladder gradually collapses; both circumstances apparently confirming the belief that the finger is really in that cavity. Indeed the latter condition affords more room for the easy enlargement of the false bladder. In this anxious and perilous moment, two points of distinction should be remembered; this false bladder presents *no neck* through which the finger should pass to gain admission, nor can the *bare* grooved staff be felt along the back of the finger when in-



roduced into the cavity. Besides both these negative features of distinction; *above* this cavity, near the symphysis pubis, lies the staff leading to the bladder; and which can be plainly felt on directing the finger from the scene of mischief, obliquely upwards to that spot. Hence, the practical inferences are these; in approaching the staff, to avoid making anatomy by a too free use of the finger as a guide; and to direct both it and the knife upwards to the more highly situated staff, instead of heedlessly slipping into and working in the interval between the bladder and rectum. A precaution before operating should also be observed; that of sufficiently distending the bladder with water, to lower its position in the pelvis and to steady its neck. The same kind of misadventure may occur between the neck of the bladder and the pubes, by misuse and misdirection of the finger *upwards*. It need scarcely be added, that in either such case, the little patient remains unrelieved, and dies with the stone in the bladder. Yet this calamity has happened to some of the most skilful and experienced lithotomists—past and present.

Again, in endeavouring to hit the membranous urethra and lodge the point of the knife in the groove of the staff; the urethra being of *small size*, it may be so cut about as to be nearly severed from the prostate. Or, if the point of the finger be not insinuated well into the opening, or if any undue force be used in passing it into the bladder; the *thin* membranous urethra may be torn across, and the neck of the bladder driven backwards on, or off, the staff,—an accident more likely to happen when the urethra has been nearly severed.

Thus then, in opening the urethra, as in approaching it, *fiddling* with the knife must be avoided; and in both procedures, any *forcible* use of the finger will also be mischievous.

The *rudimentary size* of the prostate, and the *high position* of the bladder, will both necessitate a more upward direction of the point of the knife, in making the prostatic incision. And it should be remembered that this incision must necessarily almost always, if not invariably, extend through the whole of the small prostate, in its left lobe; yet without any evil consequence.

In entering the neck of the bladder, the feeling is that of passing through a small ring; without riding over the sort of chestnut-like projection upwards of the prostate, and which may be like a half-orange in an elderly man.

When the prostate has been detached from the membranous urethra and the neck of the bladder recedes before the point of the finger; all the presence of mind and dexterity of the Surgeon will be required at this trying moment of peril and anxiety. Much will depend on whether the staff still remain in the bladder, as a guide. If so, the fore-finger should be passed most cautiously and gently along the groove, and a slight hooking-movement made at the neck, so as to draw down this part. It may then be notched, by insinuating the knife along the finger, which can thus be fairly entered. If the staff be out of the bladder, or has been withdrawn; the position of both patient and Surgeon is most critical. It may be possible to re-introduce the instrument, and then proceed as just directed. Failing to accomplish the first step, the attempt to hook down the neck of the bladder should never be resorted to,—in the absence of a *guide*. The finger or any searching instrument will only pass deeper and deeper with increasing damage, and inevitable death result. Moral courage is here the better part of valour, and any further operative interference

should be resolutely abandoned. The urethra may heal, restoring the continuity of the canal, when the operation can be repeated and brought to a happy issue.

**DIFFICULTIES, AND ACCIDENTS, DURING LITHOTOMY.**—The *Difficulties* which may occur in the performance of the lateral operation relate either; (1), to entering the bladder; or (2), to seizing and extracting the stone. The first occur more especially in operating on children, and have been already described; the second kind of difficulties happen more commonly in adults. Thus, in *children* two difficulties are very liable to happen, in endeavouring to enter the bladder; the formation of a false bladder in the recto-vesical space, and the incised or torn detachment of the neck of the bladder from the membranous urethra. In *adults*, the first of these difficulties has occurred as the result of prolonged *boring* with the finger in the cellular interval between the bladder and rectum.

(1) A *deep perineum* presents obstacles to *entering* the bladder. The depth of perineum may be due to fat, in a corpulent person; or to an enlarged prostate, in an elderly person. Both conditions not unfrequently co-exist, coupled also with an indurated state of the prostate. A forefinger of average length can perhaps scarcely reach the bladder, if at all; and the prostatic condition of enlargement and rigidity obstructs the introduction of the finger. The blunt-gerget, formerly in ordinary use, is here very appropriate; as affording the means of dilating the incomplete incision in the enlarged and indurated gland, and of gaining access to the bladder beyond reach of the finger.

(2) *Seizure and extraction* of the stone may present difficulties dependent on several conditions;—depth of the perineum, particularly when due to an Enlarged Prostate; an Encysted, or an adherent state of the stone; the Position, Size and Shape of the stone; Rickety deformity of the pelvis, in its antero-posterior diameter, or by narrowing of the pubic arch. These various conditions interfere with the use of the forceps; either in introducing the instrument into the bladder, in seizing, or in extracting the stone.

*Enlargement of the Prostate*, which places the bladder beyond reach of the finger, renders the introduction of the forceps difficult; and seizure of the stone more so, owing to the liability of its falling into the depression behind the prostate, and thus escaping the sweep of the forceps. In extracting the stone through an enlarged prostate, difficulty may be experienced; and rather than bruise or lacerate the parts, it would be proper to incise the opposite side of the prostate towards the right tuberosity of the ischium; thus forming a bilateral section of this body, without making any additional perineal incision.

*Encysted calculus* is not of very common occurrence; but if this condition be found in exploring the bladder with the finger, the course to be taken by the Surgeon should depend entirely on the size of the aperture of the sacculus. A small aperture will preclude the possibility of removing the stone, without endangering life. A large opening, or a partially encysted condition, may allow the stone to be liberated. This can sometimes be effected by a fortunate catch with the forceps; in one case, by Collot, changing the position of the patient proved successful in dislodging the stone; in another, by Sir B. Brodie, the orifice was enlarged with a probe-pointed bistoury, and the calculus turned out with the finger or scoop. The latter procedure is, obviously, extremely hazardous, since the bladder might easily be cut through into the peritoneal cavity. When, therefore,

the calculus cannot be otherwise removed, and with tolerable facility, the operation should, as Coulson observes, be abandoned. An encapsuled calculus was once found by Mr. Erichsen, in a child; the stone, about the size of a pea, being felt at the inferior fundus of the bladder, covered in by a kind of false membrane. This membrane was scraped through with the nail, and the stone removed with a scoop. The cyst attached, was about the thickness of ordinary writing paper, of a reddish colour, consisting of organized fibro-cellular tissue, and resembled mucous membrane. Excepting a slight attack of secondary hæmorrhage on the eighth day after operation, the patient made a good recovery.

*Enveloping folds* of mucous membrane are sometimes met with, the stone thus eluding the grasp of the forceps. This mechanical difficulty must be overcome by manœuvre with the forceps, or by the more direct and safe means of the finger and scoop.

*Hour-glass contraction* of the bladder, the stone being placed in the upper compartment, will probably necessitate recourse to the high or supra-pubic operation of lithotomy.

An *adherent* state of the calculus has been doubted by some authors; but an indisputable case is recorded by Mr. Shaw in the Transactions of the Pathological Society, vol. vi. The adhesion of the mucous membrane to the stone was effected by fibrous tissue, the fibres dipping into the calcareous substance; and this union was so firm that it resisted separation by tearing with the forceps. In extracting phosphatic calculi, the deposit of rough calcareous matter on the rugæ of the bladder must not be mistaken for a distinct calculus; any attempt to remove the former would of course prove disastrous by tearing away the mucous membrane with the deposit.

*Position of the stone.*—Two parts of the bladder, in either of which the calculus may be situated, offer considerable difficulty to *seizure* of the stone. When lodged in a depression behind an enlarged prostate; the stone must be brought up by tilting the bladder with the finger introduced into the rectum, and then using a curved pair of forceps or a curved scoop. When situated above the pubes anteriorly, towards the upper fundus of the bladder; the stone must be lowered by compressing the abdomen, as Aston Key recommended, and then seizing with a curved forceps or the curved scoop. In one such case, Sir B. Brodie found the stone both encysted and adherent. Raising the pelvis will sometimes enable the forceps to grasp the stone, a resource which proved successful in a case on which Mr. Coulson operated.

*Shape and Size of the Stone.*—The shape of the stone may offer some difficulty to its *seizure* with the forceps. A round irregular stone, as a mulberry calculus, is grasped less readily than a flattened, smooth stone, which lies easily within the blades of the forceps. Irregular shaped, phosphatic calculi, present the greatest difficulty.

Both the shape and large size of the stone may offer considerable obstacles to its *extraction*. Three resources are practicable;—(1) section of the right lobe of the prostate, forming the bilateral section of this body, (2) crushing, splitting, or drilling up and breaking up the stone in the bladder—by means of strong lithotomy forceps, cutting forceps, or lithotrites,—thus performing perineal lithotrity; (3) the recto-vesical, or the supra-pubic operation of lithotomy. Of these procedures, section of the prostate is most practicable and the safest. It was recommended by Liston and Martineau, rather than use undue force in attempting to gradually



dilate the ordinary prostatic incision, which would cause bruising or laceration. The forceps still grasping the stone is held fast by an assistant, and the right lobe of the prostate is then incised towards the right tuber ischii, by passing the knife or a blunt-pointed bistoury along the blade of the instrument as a director. In this way, Martineau often enlarged the opening, repeating the incision two or three times. Crushing the stone in the bladder through the perineal wound, is a more dangerous procedure; the instrument required must be of some size and strong; its application may be attended with some injury to the bladder, which is often firmly contracted on the stone; and the fragments of stone, as sources of irritation or centres of secondary calculi, must be thoroughly removed by repeatedly injecting and washing out the bladder with tepid water. The recto-vesical, or the supra-pubic operation would be preferable to crushing, in most cases.

*Fracture* of the stone is apt to happen when the calculus is brittle, or soft; breaking into several sharp fragments, or squashing into a soft mortar-like mass. It occurs mostly to phosphatic calculi. This breaking-down of the stone results usually from too firm a grasp with the forceps; either lest the stone should slip away, or by pulling too high up and coming in contact with the pubic arch, or in consequence of the pressure requisite in extracting a large-sized stone. The fracture generally leaves a central stone in the blades of the forceps, which should be extracted; and the detached fragments removed by the repeated introduction of this instrument or the scoop, and the bladder thoroughly washed out. Detritus will probably still remain, and small fragments may be discharged through the wound for some days; then the bladder should be injected daily through a catheter passed down the urethra, and the water made to escape freely by the wound; the stream carrying with it particles of calculus. This plan should be continued until no more detritus is brought away. If the wound has healed, the fragments remaining must be washed out through the urethra, by means of a catheter, as after lithotrity.

*Rickety deformity* of the pelvis, although not a common cause of difficulty in lithotomy, may present insuperable obstacles in extracting the stone. If the brim of the pelvis be narrowed in its antero-posterior diameter; the difficulty of extraction will be increased in children, owing to the high position of the bladder. Narrowing of the pubic arch, which is always narrow in children, may quite preclude extraction, or even the introduction of the forceps. These conditions should be ascertained *before* operation, and supra-pubic lithotomy performed.

The *Accidents* which may happen during the lateral operation are:— (1) wound of the rectum; (2) hæmorrhage, arising either from the vessels necessarily divided, or from the pudic artery or the artery of the bulb, or from certain accidental deviations of these vessels, and from the prostatic or other veins; (3) wound of the bulb; (4) missing the urethra and entering the bladder beyond the prostate; (5) penetration of the posterior part of the bladder from within its cavity.

The three first named accidents have already been adverted to in considering the parts to be avoided in performing the lateral operation; and when either of these accidents occurs, the treatment should be conducted on ordinary principles.

(1) *Wound of the rectum* is important according to its size or situation. A small puncture, low down near the anus, may be left to itself; a little feculent fluid may escape from the perineal wound for some days,

along with the urine; but as granulation closes up, this ceases, and the urine is transmitted through the urethra. A larger-sized aperture, or when situated higher up the bowel, had better be dealt with at once and in the same way as fistula in ano. The bowel should be laid open into the perineal wound, by an incision from the accidental aperture downwards through the sphincter ani, so as to form one cavity. Granulation from the bottom may then restore the continuity of the bowel. Otherwise, a recto-vesical fistulous communication will remain.

(2) *Hæmorrhage* must be managed on ordinary principles; by ligature or torsion of any distinctly bleeding artery that may be accessible; or by pressure. The artery of the bulb is the principal source of serious, or even fatal hæmorrhage; and so also would be the internal pudic, as it can scarcely retract within the obturator fascia overlaying it; but this vessel is well protected under cover of the ramus of the ischium. Either vessel is best secured by compression; ligature being inapplicable in most cases, as the vessels cannot thus be reached. Compression is applied most effectually by means of digital pressure; provided the bleeding vessel can be commanded with the finger, and relays of assistants are at hand. In the course of fourteen or twenty-four hours,—according to cases related by South and Brodie, continued digital pressure succeeded in permanently stopping hæmorrhage from these vessels. The ramus of the bone offers an excellent counter-resistance to the finger. *Oozing* hæmorrhage, of a persistent character, may be effectually arrested by plugging the perineal wound. This is precisely the condition in which Liston's gum-elastic tube may be used with advantage, while free vent also will thus be given to the urine. The track of the wound is plugged with dossils of lint around the tube; or more conveniently, by pieces of sponge introduced into a conical bag of oiled silk attached to the tube, as devised by Mr. Hilton. The tube is kept free of coagula by the occasional introduction of an oiled feather. *Venous* hæmorrhage, proceeding chiefly from the prostatic plexus of veins, may be arrested in like manner. Hilton's contrivance has here proved very successful. A case is related in the Medical Times, 1855. Sir B. Brodie lost a patient within a few hours after operation, from venous hæmorrhage; every effort having been made in vain to arrest it. *Retrocedent* hæmorrhage, the blood, arterial or venous, passing back into the bladder, sometimes occurs and to an alarming extent. Bloody urine escapes by the wound, but the bladder becomes distended; there is dulness on percussion above the pubes, and faintness ensues. Injections of cold water should be used to wash out the bladder; and ligature or plugging applied, according to the nature and source of the hæmorrhage.

(3) *Wound of the bulb* is an accident of no serious consequence.

(4) *Missing the urethra, and entering the bladder beyond the prostate*, allows of infiltration of urine into the pelvic cellular tissue. Diffuse inflammation and death will almost necessarily follow. Yet this fatal accident has occurred, once in a way, to the most skilled lithotomists.

(5) *Penetration of the posterior part of the bladder*, is liable to occur from passing the knife too deeply along the groove of the staff; the point may slip out and penetrate the posterior wall of the bladder. An insufficiently injected bladder would be more exposed to this accident. I have never yet known it to occur.

In *children*, the accidents specially incident to lateral lithotomy, have been fully considered in describing the operation as performed before puberty or at an earlier period of life.

**AFTER-TREATMENT.**—When no accident has occurred during the operation, the treatment after lateral lithotomy is simple. The patient is placed on his back in bed, with his legs apart and the knees somewhat raised on pillows. The urine will thus drain away through the wound, as it is secreted; preventing the chance of urinary infiltration. A draw-sheet covered with Mackintosh cloth, having been previously placed under the buttocks, will enable the nurse to keep the patient clean and dry without altering his position. No dressing is required, a sponge or small spittoon-pot is placed under the wound against the nates to catch the urine as it drops. If Liston's gum-elastic tube has been passed up the wound into the bladder, and there retained by perineal tapes; this channel can be kept free from coagula and open for the distillation of the urine, by occasionally introducing an oiled feather. When I was a student, this precaution was observed so diligently, that the dresser in attendance sat by the patient's bed-side, the night after operation, for the purpose of thus freeing the tube. It was retained for about twenty-four hours, in a child; and about forty-eight hours, in an adult. By that time its retention was thought unnecessary; the sides of the wound having become glazed over with lymph, whereby the risk of infiltration will have ceased. An opiate should be given, and repeated when necessary, to secure sleep or at least quiescence; and diluent drinks allowed plentifully, with light fluid food, as milk, arrow-root or beef-tea, during the first three or four days. In an elderly person, it may be requisite to soon have recourse to stimulants. *Retention* of urine sometimes occurs, and must be instantly relieved by passing a gum-elastic catheter or the finger up the wound to the neck of the bladder. Warm fomentations and opiates will then allay pain and irritation. About the fourth or fifth day, the urine may suddenly cease to escape through the wound, and be discharged through the urethra;—the patient "wets," as nurses are accustomed to understand it. This, however, seems due to a temporary turgescence in the wound, resulting from inflammatory swelling which occludes the outlet; subsiding in a day or two, the urine again escapes by the wound. The same temporary discharge of urine through the natural passage may happen at an earlier period,—within twenty-four hours after operation. It is not at all a favourable sign. Urine having again returned through the wound, the quantity gradually diminishes during contraction and granulation, a portion coming away by the urethra; until the wound closes about the end of a fortnight to three weeks. The cure is completed in from thirty to forty days. In the case of a large mulberry calculus which I removed from a man sixty-five years of age, the patient returned sound to Hastings, at the end of a month. Phosphatic calculi generally entail the longest period for recovery after operation.

*Morbid conditions* of the wound, as that of sloughing or suppuration, must be treated accordingly.

*Urinary fistula* sometimes remains, with incontinence of urine, temporary or permanent. This result is met with mostly in children, and it generally ceases as age advances. Closure of the fistulous tract may perhaps be effected by occasionally passing a probe coated with nitrate of silver, or by the galvanic-wire cautery.

*Incontinence* alone may occur, particularly in childhood, if the patient be allowed to get up too soon, before the sphincter of the bladder has recovered its tone. *Impotency* sometimes results, from wound or injury



involving the ejaculatory ducts in the substance of the prostate. *Fæcal fistula* may be the result of a wound of the rectum; or of bruising of the bowel, either by a forcible use of the finger in the act of protecting it, or during extraction of the stone.

CAUSES OF DEATH, AND RESULTS, AFTER LATERAL LITHOTOMY.—The principal *causes of death* are:—(1) Age; (2) Large Calculus and Pelvic cellulitis; (3) Disease of the Kidneys; (4) Hæmorrhage; (5) Shock; (6) Cystitis; (7) Peritonitis; (8) Pyæmia.

(1) Age has a remarkable relation to the mortality after lithotomy. The lateral operation is rarely fatal in childhood; a dangerous operation, in middle life; and a perilous or fatal operation, in old age. This operation has been found to be four times as fatal in adults as in children, at the Norwich and Norfolk Hospital. Cheselden lost only 1 patient out of 35 under ten years of age; and of the cases recorded by Mr. South (in Chelius) as having been operated on at St. Thomas's Hospital during a period of twenty-three years, the mortality, at that period of life, was only 1 in 58. Coulson's table of 2972 cases shows an increasing mortality at each successive decennial period:—under ten years, it is 1 in 13; it thence gradually rises, after ten to eighty years; to 1 in 9, 1 in 6, 1 in 5, 1 in 4, 1 in 3·65, 1 in 3·23, 1 in 2·71. The mortality at *all ages*, rates at 1 in 9, according to the St. Thomas's table of 125 cases where the age was stated; but in 1827 cases, collected by Sir H. Thompson from the Metropolitan and Provincial Hospitals, the average mortality was higher,—nearly 1 in 8; and in Coulson's general table of 6505 cases, male and female, the average mortality rises still higher,—to 1 in 6·56, or about 2 in every 13 cases.

(2) *Size of the Stone*.—A large stone is far more dangerous than a small one, in regard to the result of operation; and the danger increases with the size; or *weight*, of the stone. This may be due, either to bruising and laceration of the neck of the bladder, or to infiltration of urine and pelvic cellulitis; as the result of forcible extraction. Crosse's table of 704 cases, in the Norwich Hospital, shows the increasing danger according to the size of the calculus, estimated by its weight. When the weight of the stone was under 1 ounce, the deaths were in the proportion of 1 in 11·25 cases; from 1 to 2 ounces, 1 death in 6·61 cases; from 2 to 3 ounces, 1 in 2·18; from three to four ounces, 1 in 1·57; and from 4 to 5 ounces, 1 in 1·66 cases. The chance—observes Mr. Coulson—which a patient has for recovery after lithotomy can, therefore, be calculated beforehand, and independent of every other consideration, from the ascertained dimensions or weight of the stone.

(3) *Disease of the kidneys*.—Chronic pyelitis, or chronic nephritis resulting in degeneration of the kidneys with albuminous urine, may be said to represent that diseased condition of the kidneys which is most prejudicial to recovery after lithotomy.

In estimating the comparative mortality of lithotomy in *adults* and *children*, two elements seem to be in favour of the latter;—at an early period of life, the kidneys are usually sound, and the stone of small size,—thus entailing less liability to injury of the neck of the bladder, or to infiltration of urine followed by pelvic cellulitis.

In children, death generally results from some accidental violence; as the formation of a false-bladder in the recto-vesical space, or disruption of the neck of the bladder from the membranous urethra. In adults, however skilfully the operation may have been performed, the

state of the kidneys and the size of the stone may severally lead to a fatal issue.

(4) *Hæmorrhage* may occur primarily, or secondarily after the operation; in the latter case it takes place in about a week, or ten days, or even a fortnight. Primary hæmorrhage is rarely fatal; in Liston's experience, one such case happened in 100 operations; and Coulson has not experienced dangerous hæmorrhage frequently; but in France, Begin affirms that it is the cause of death in 1 out of every 4 deaths, and Boyer regards hæmorrhage as one of the chief dangers of lithotomy.

(5) *Shock*, as the cause of death is very uncommon; and it generally happens in old people.

(6) *Cystitis* is also a rare cause of mortality; although Boyer attributes three-fourths of the deaths after lithotomy to this cause, or its consequences by extension to the kidney or peritoneum.

(7) *Peritonitis*, as a consequence of cystitis or pelvic cellulitis, may thus cause death; but peritonitis *per se*, is a rare occurrence, especially in adults.

(8) *Pyæmia* may be consequent on peritonitis; but it more frequently arises from inflammation of the prostatic plexus of veins, and generally in old persons, at the end of a week or fortnight.

In estimating the results of lithotomy, no Surgeon should judge from his own experience of a *limited* number of successful cases, in succession. I, for instance, have not yet lost a case; and Surgeons of very extensive experience are well aware of the fallacy of these serial cases. It has been truly said that "ten, twenty, thirty cases may succeed without interruption, and the operator flatters himself he is never to lose a patient, when two or three deaths follow in quick succession, and reduce him to a level with his neighbours, or at least within the limits of variation which the analysis of a large number of cases indicates."

RECURRENCE OF STONE.—After the lateral operation of lithotomy, and after the median operation also, a second stone sometimes forms. The liability to this recurrence, of calculus, and its relation to various circumstances, has been statistically investigated by Mr. C. Williams, House-Surgeon at the Norfolk and Norwich Hospital. From the opening of the Hospital in 1772 to November 1863, or during a period of ninety-one years, 923 cases of stone in the bladder underwent some form of lithotomy, excluding 2 cases of lithotritry; of these, 24 suffered a relapse, and underwent a second operation. The proportion of such cases to the whole number of stone-patients is 1 in 38·45. Of the 24 cases of recurrence, and a second operation of lithotomy; 19 were cured, and 5 died; 3 had stone a *third* time, 2 of which were cut and recovered, the third was deemed unfit for operation. All the patients were males, no instance having shown itself of recurrence in the female. In respect to *age*;—6 of the cases were under ten years of age; 2 between ten and twenty; 1 between twenty and thirty; 4 between thirty and forty; 2 between forty and fifty; 2 between fifty and sixty; and 7 between sixty and seventy. One death occurred below forty years of age; and four above that period of life. The *period* of recurrence varied from one year to twelve years; the average period was thirty-three months. *Lateral* lithotomy was performed in all the cases, excepting 8; 2 of which were cut on both occasions by the median operation, and in 4 this operation was resorted to on the second occasion. In 14, the calculi were removed in a perfect and entire condition at the first operation; while in 8, the calculi were broken in the extraction; in 1 the

stones were very small and numerous; and in the remaining 1, a sacculated stone was left undetected in the bladder. The nature of the second calculus was not in all cases the same as that of the first; in 16, the second formation had the same composition as the first, 9 of which were phosphatic while 7 consisted of lithic acid and the lithates; the phosphates succeeded the lithates in 5, and the oxalates in 2 cases.

**MEDIAN LITHOTOMY.**—The median operation of lithotomy is so named, because the incision is made in the *middle line* of the perineum. But this operation comprises two methods of procedure in relation to the *prostate*; a vertical section of the membranous urethra alone, and then dilatation of the prostate with the neck of the bladder,—“*lithectasy*” in the male, as it might be termed; or a vertical section of the prostate, as well as of the membranous urethra. Formerly the one was called also the “*Marian operation*,” as having been advocated by Sanctus Marianus; and the “*operation of the apparatus major*” from the number of instruments employed in performing it.

*The Old Marian Operation.*—A grooved staff was introduced into the bladder, and the patient trussed up as for lateral lithotomy; the operator then made a vertical and nearly central incision, just to the left of the raphé, and terminating just above the anus. The *membranous urethra* was opened in the groove of the staff, and the knife being kept well in the groove, a long probe was passed by the side of the knife into the bladder. Both staff and knife were then withdrawn, leaving only the probe as a guide to the bladder. Along this instrument two iron rods or “*conductors*” were introduced, and by separating their handles, the prostate and neck of the bladder were dilated,—or as John Bell observes, the operator “*tore open the prostate*.” The *conductors* were held aside, and “*dilators*” introduced to make way for the forceps, wherewith the stone was extracted. Thus, as Le Cat expressed it, the two principles of the Marian operation were; “*small incision, much dilatation*.” Vacca revived the median operation, and practised also a vertical section of the *prostate*; thereby avoiding laceration of this part, but endangering the rectum.

*Allarton's Operation.*—The Marian Operation had long fallen into disuse, but of late years it has been revived and slightly modified by Mr. Allarton; and with his name Median lithotomy is now generally associated, in this country.

The operation is performed much in the same way as by the old Marian operation, up to the introduction of the probe into the bladder; when the *fore-finger*, instead of dilators, is introduced along the probe, and with a semi-rotary motion, the prostate is thus dilated. The points to be attended to are these:—the curved staff is held by an assistant, firmly, perpendicularly, and hooked up against the pubes; the fore-finger of the left hand is introduced into the rectum, so that its point shall steady the staff in the prostate; a straight, sharp-pointed knife is entered into the perineum, in the *middle line*, about half an inch above the anus, and carried on steadily till it strikes the groove of the staff at the membranous urethra in front of the prostate,—a depth of about one inch and a half; the knife is moved along the groove towards the bladder for a few lines deeper, and then withdrawn, at the same time cutting upwards an external incision of  $\frac{3}{4}$  to  $1\frac{1}{2}$  inches, according to the presumed size of the stone. A long ball-pointed probe is slid along the groove of the staff into the bladder, and the latter instrument then withdrawn, as in the old Marian



Operation. But the left fore-finger is passed along the probe into the bladder, and used to dilate the prostate and neck, serving also as a guide to the forceps. When the stone is free, it comes at once into contact with the finger, and, if of moderate size, passes readily into the wound on withdrawing the finger; the patient having power to strain upon and thereby facilitate the extraction of the stone.

The advantages claimed for the median, over the lateral operation, are; that the incision being strictly in the median line, no muscles are divided, and no gaping open wound is left; the integrity of the bladder being preserved, and no chloroform given, the patient himself helps to expel the stone. This operation is most suitable for *small* stones.

The *results* of Median, as compared with those of Lateral Lithotomy are decidedly unfavourable; a difference owing doubtless to the fact, that in median lithotomy, without section of the prostate, this gland and the neck of the bladder are bruised and lacerated by the dilatation,—whether with “dilators” or the “fore-finger.” Thus, comparing the results of 44 cases of median lithotomy with the last 44 current cases of lateral lithotomy in the Norwich Hospital, 1863; Mr. Williams’s table shows that of the median cases, 11 died, whereas of the lateral cases, only 2 died. The average period of recovery was seven days in favour of the median operation, thirty days instead of thirty-seven.

*Rectangular Staff Operation.*—Dr. Buchanan of Glasgow introduced this procedure, which is a modification of the median operation. He uses a rectangular staff, with the short branch grooved at its side. This instrument having been passed into the bladder; the angle is made to correspond in situation with the front of the prostate, the lower or grooved branch lying parallel to the rectum. The left fore-finger is passed into the rectum, and a long straight knife, held with the blade horizontal and the edge turned to the left, is made to enter the perineum opposite the angle of the staff and passed straight into and along the groove, into the bladder. The membranous urethra is thus left *untouched*. In withdrawing the knife, a lateral section of the prostate is made, in its left lobe; and at the same time, an external incision downwards and outwards, round the upper and left side of the anus, to about  $1\frac{1}{4}$  inches in extent.

Certain features in this operation are adduced in its favour:—the more direct line to the prostate, which, at the angle of the staff, is situated close to the surface of the perineum; the membranous portion of the urethra is avoided; all blood-vessels are out of the way, and consequently there is no important hæmorrhage; the rectum is less liable to be wounded; and there is less risk of deep-seated infiltration of urine.

*BILATERAL LITHOTOMY.*—Dupuytren’s operation consisted in making a semilunar incision, transversely, in front of the anus; the convexity of this incision being upwards, and the horns extending laterally to between the anus and the tuberosity of the ischium on either side. The tissues were carefully divided upwards to the membranous urethra, avoiding the rectum; this portion of the urethra was opened by a median incision from before backwards, with a double-edged bistoury; then, the curved double lithotome was passed along the groove of the staff into the bladder, the staff withdrawn, and the concavity of the lithotome being directed downwards, the blades were opened, and, in withdrawing the instrument, both sides of the prostate were divided obliquely downwards and outwards to the requisite extent. The extraction of the stone is then accomplished in the usual manner.

The results of this operation are unfavourable; 19 deaths having occurred in 85 cases, or 1 in  $4\frac{1}{2}$  cases.

*Medio-bilateral Operation.*—Civiale, in 1836, modified the median operation by his medio-bilateral procedure. It consisted of a median perineal incision, followed by a transverse section of the prostate with a straight double-bladed lithotome, which was passed into the bladder through the membranous urethra, along the groove of the staff, and the blades withdrawn open.

QUADRILATERAL SECTION OF THE PROSTATE has been recommended by Vidal de Cassis, in cases of *large* stone; no matter what the direction of external incision may be, so that it is not too small,—whether oblique, vertical, transverse, or curved. The principles of this operation are; to have one large external incision, and many small internal ones. The two first sections of the prostate are made along the inferior oblique diameter of the gland on either side, which will prove sufficient when the stone is of moderate size; but, two superior oblique sections must be added, first one and then the other, when the stone is large.

RECTO-VESICAL OPERATION.—Lithotomy through the rectum is claimed by Sanson as his procedure. A grooved curved-staff having been introduced into the bladder, a vertical incision is made, corresponding to the raphe of the perineum, and dividing the sphincter ani and lower part of the rectum. Continuing the dissection, the membranous portion of the urethra and prostate are exposed. A vertical section of the prostate is then effected; either by passing the knife along the groove of the staff from before backwards, or by entering the knife behind the prostate and drawing it forwards on the finger in the groove of the staff. A portion of the base of the bladder, uncovered by peritoneum behind the prostate, may even be divided. The staff is withdrawn, the finger introduced, and the stone extracted with the forceps.

This operation has been recommended on the ground of its affording an easy passage for extracting instruments, and as being free from the risk of hæmorrhage. But there is great risk of wounding the peritoneum and vesiculæ seminales; and of the subsequent occurrence of urinary infiltration, the passage of feces into the bladder and recto-vesical fistula. Coulson has seen cases of permanent fistulous communication. This method of lithotomy has, therefore, been discarded; and it cannot be deemed advisable even in cases of impacted calculus in the wall of the bladder.

The *results* are very unfavourable; in 185 cases thus operated on, 38 died, being a mortality of 1 in 4.86. And the subsequent condition of those who recovered is not stated.

SUPRA-PUBIC, HYPO-GASTRIC, OR HIGH OPERATION.—The *size* of the calculus, or the state of the *perineum*, especially with regard to the pelvic outlet, may render perineal lithotomy, in any form, impracticable. Under these circumstances, or other impracticable conditions, recourse may be had to supra-pubic lithotomy. In *children*, and persons below twenty years of age, the bladder stands high above the pubes, and presents a portion uncovered by peritoneum, which is freely accessible; under eight years, the peritoneal reflection from the bladder does not generally reach lower than one inch and a half to two inches from the navel. In *old* persons, especially when emaciated, the bladder lies deep in the pelvis, behind the symphysis pubis, and would be difficult to reach.

In order to perform supra-pubic lithotomy, the bladder must be made

to rise above the edge of the pubis; and this may be accomplished either by full distension of the bladder with water, or by means of a catheter or other instrument introduced through the urethra into the bladder, so that its point shall project above the pubes. Both means are adopted to ensure a presenting part or point of the bladder in that situation. The operation consists in making a vertical incision in the middle line, above the pubes, carried upwards to about three inches in length; the linea alba is exposed, and the incision carried through the muscular wall of the abdomen and fascia transversalis; the projecting part of the bladder, uncovered by peritoneum, is sought just above the symphysis, and opened on the point of the instrument within its cavity; this incision being prolonged downwards towards the neck of the bladder with a probe-pointed bistoury, sufficiently to admit the finger. The forceps is then passed in, and the stone extracted. Various instruments have been devised wherewith to puncture the bladder from within, when reached by the incision. Thus, the *sonde-à-darde* is a puncturing instrument, combining a trocar concealed in a catheter; and this is used by Civiale. The performance of this operation is much more difficult than it would appear to be.

The *after-treatment* is simple; urinary infiltration is prevented by placing the patient on his back, and it may perhaps be advisable to introduce a gum-elastic catheter into the bladder, leaving it there for a few days until union of the wound has taken place. Formerly, it was thought necessary to close the bladder by sutures; and even to make a counter-opening through the perineum into the membranous urethra or the neck of the bladder, with a view of securing a free drain for the urine. These complications are now entirely discarded, whenever the operation is occasionally resorted to.

The *results* of this operation are, however, singularly fatal. Professor Humphry of Cambridge has shown that in 104 cases, 31 were fatal, mostly in consequence of peritonitis and urinary infiltration; a mortality of 1 in 3·08. He had himself 1 successful case, and other Surgeons, especially M. Souberbielle and Dr. Carpenter of Pennsylvania, have also had occasionally a successful result. But it should be remembered that the operation is had recourse to when the stone is of unusually large size, and the lateral operation being inapplicable, the results of the two methods cannot fairly be compared.

**LITHOTRITY.** — The operation of breaking-down the stone in the bladder, so as to allow of its extraction, or discharge, by fragments through the urethra; was early devised and attempted, in some way, as a substitute for the cutting operation of lithotomy. This procedure was noticed by Hippocrates amongst the Greeks; by Albugenis of the Arabian school; by Franco, Guido de Cauliaco, Hildanus, Haller, and other authors down to the end of the last century. In 1813, Gruithuisen, a Bavarian Surgeon, published two memoirs on the subject; describing his instruments for the drilling or boring, and then crushing the fragments, of stone in the bladder. But these isolated and imperfect attempts failed to introduce Lithotritry into the Practice of Surgery. Civiale, in 1817, then a poor student, first succeeded in drawing attention to Lithotritry, by constructing certain boring instruments, which he brought before the notice of the French Minister; and continuing his labours in subsequent years, followed by Amussat in 1822, and Leroy d'Etiolles in 1823, this method of removing stone from the bladder acquired a recog-



nised and established reputation in France. Subsequently, in this country, the first *crushing* instrument of any value, was invented by Mr. Weiss, in 1824. It consisted of two blades, sliding one within the other, and worked by a screw at the handle. With a somewhat similar instrument, in 1825, Mr. Hodgson at the Birmingham Hospital, first performed the operation of crushing stone in the bladder. Heurteloup in 1830, and Costello afterwards, devised an instrument for hammering the stone to pieces; but the crushing procedure prevailed, and was mainly brought into practice by Sir B. Brodie. It is also worthy of record, that the oval slit in the under or female blade for the escape of detritus, in using

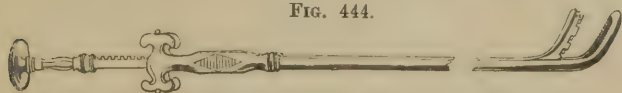
FIG. 443.



the lithotrite, was suggested by Mr. Oldham, a gentleman connected with the Bank of England. Since the period referred to, lithotrity has received the special attention of Coulson, Sir W. Fergusson, Skey, and Sir H. Thompson. The latter Surgeon may justly be entitled the champion authority respecting this operation, he having presented the results of his extensive experience in *An Analysis of 181 Consecutive Cases of Stone in the Bladder of the Adult, treated by Lithotrity.* (Med.-Chir. Trans., 1870.)

The *Lithotrite*, or instrument for crushing the stone, now generally

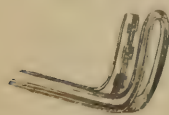
FIG. 444.



used is Weiss's "newly-invented Lithotrite," or Sir Henry Thompson's admirable lithotrite. It enables the operator to exercise powerful, yet nicely regulated screw-pressure; its cylindrical and finely fluted handle aids the sense of touch; and the whole is a light and delicate instrument. The handle, slightly modified, as used by Sir William Fergusson, is here represented. (Fig. 443.) Another form of instrument

is also used by the latter distinguished operator,—a rack and key lithotrite (Fig. 444); but which is I believe less generally used. I prefer a screw instrument, and especially Thompson's lithotrite, for the three reasons just stated. The fenestrum or oval aperture in the under blade (Fig. 445), is of great importance, as already stated; Civiale's lithotrite

FIG. 445.



(Fig. 446), having no aperture in the female blade, may be used for crushing fragments of stone. A steel sound, for detecting fragments, is also very serviceable; and an injecting apparatus

FIG. 446.



will be required, consisting of large-eyed catheters of different sizes, and a strong, large-sized brass syringe, the nozzle of which fits the catheters.

*Preparation of the Patient for Lithotrity.*—Prior to any operation for breaking-up a stone in the bladder, it is absolutely necessary that not only should the general health be attended to, but that the bladder more especially should be brought into as quiet a condition as possible. Freedom from vesical irritability or inflammation is more important in relation to lithotrity than to lithotomy; the former operation being perhaps an unavoidably more prolonged procedure within the bladder, a repeated operation, and one which leaves fragments of stone behind as a continued source of irritation during their discharge. Hence, if the bladder or kidneys be diseased, lithotrity should be postponed or abandoned.

*Lithotrity* is thus performed:—The patient having been placed recumbent on a bed or couch of convenient height; the pelvis should be slightly raised on an unyielding pillow so as to bring the lower fundus of the bladder in a line with the urethral orifice; the head and shoulders should be supported by pillows, and the legs separated and somewhat flexed. Chloroform may, or may not, be administered. Civiale and Sir B. Brodie were both averse to its anæsthetic influence, alleging that the feelings of the patient are a safe guide in two essential matters; as to whether any injury is being inflicted on the bladder, and whether the operative proceeding is continued beyond what the bladder and constitution are capable of enduring. But, assuming a due manipulative skill in using the lithotrite; the irritable state of the bladder, and a nervous, restless state of the patient, in many cases, will as often render the influence of chloroform an invaluable or indispensable adjunct in performing lithotrity. The bladder is first emptied, and then injected with tepid water until it contains about five to seven ounces of fluid; in order that its cavity shall be sufficiently distended to remove the mucous membrane from the blades of the lithotrite in seeking the stone, and to make room for crushing without injuring the bladder by splintering. In old cases of stone, the bladder may be so thickened and irritable as to eject a few spoonfuls of fluid; then the injection must be repeated very slowly, and gradually, pausing occasionally until the bladder becomes accustomed to the increasing distension. On no account without sufficient dilatation of the bladder should the operation be proceeded with. Then, the Surgeon, standing on the right side of the patient, as the most convenient position, introduces the oiled lithotrite cautiously, along the urethra. The abrupt curve of this instrument, unlike the arched curve of the catheter, and resembling that of a sound, must be remembered as soon as the instrument reaches the curved portion of the urethra. By depressing the handle slowly down to a right angle with the perineum, the end of the lithotrite is brought into the direction of the canal under the pubic arch, and thence passed gently into the bladder. A slight rotatory movement with the instrument will always indicate when it has entered the bladder.

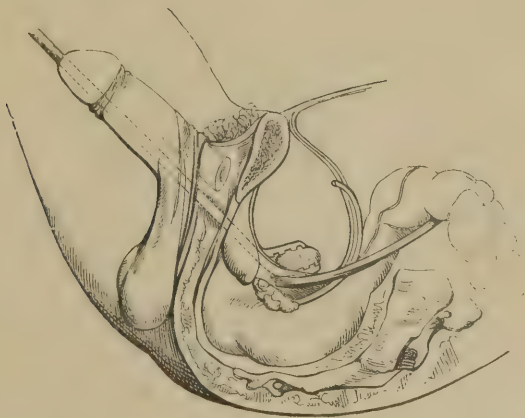
*Seizure of the stone* may be effected in either of two ways; by making it *fall* into the blades of the lithotrite, or by *searching* for it in a certain manner.

Sir B. Brodie recommends that the instrument should be raised, the blades opened, and that the convex extremity of the under or female blade should be rested against the lower fundus of the bladder, and gently pressed down, so as to make a conical *depression* in this situation; into which the stone falls by its own weight, or by a slight shake or jerk of the instrument with the hand. Similarly, Mr. Skey gives a smart blow with the open hand against the pelvis of the patient, a *coup*, he says,

which will succeed again and again in making the stone fall into the grasp of the lithotrite. The male branch is pushed forwards to seize the stone. This manœuvre may have to be repeated several times before the stone is securely caught; the female branch remaining stationary, while the male branch is slid a little up and down alternately, until the stone is seized. Civiale recommends another method, in principle, as Sir H. Thompson observes, the reverse of the preceding. By position of the patient, the centre of the bladder and space beneath it are selected as the area of operation; *no depression* is made; contact between the walls of the bladder and the instrument is, as much as possible, avoided. The instrument is applied to the stone in the situation which it naturally takes, and the operator carefully avoids moving it, or any movements of concussion whatever, however slight.

The *situation* of the stone is often ascertained in *passing* the lithotrite; then, the blades are inclined slightly away from the side on which the stone lies, carrying the instrument backwards also towards the posterior wall of the bladder, while the male blade is slowly withdrawn, not to impinge on the neck of the bladder. Turning the opened lithotrite over towards the stone, and slowly closing the blades, the stone will almost certainly be seized (Fig. 447.) Most frequently the stone will be caught on the

FIG. 447.



right side of the floor of the bladder. If no stone be felt on entering the bladder, its cavity is *explored*; first, without altering the axis of the shaft of the instrument from its central or vertical position, by simply inclining the open blades to the right side, and then to the left side; finding no stone; secondly, depress the handle of the instrument about half an inch, thereby raising the open blades slightly from the floor of the pelvis to a horizontal plane, and turn them to the right and left. In completing each of these movements, the blades are closed to seize the stone. These five positions—vertical, right and left incline, right and left horizontal, will explore the bladder fully—middle, right and left, and will thus almost certainly find any stone of moderate size in a healthy bladder. If the prostate be enlarged, and the stone possibly lodged in a depression behind



it; or if the latter is small, or a fragment only, the blades may be reversed or turned downwards, when the stone will often be found and secured with ease.

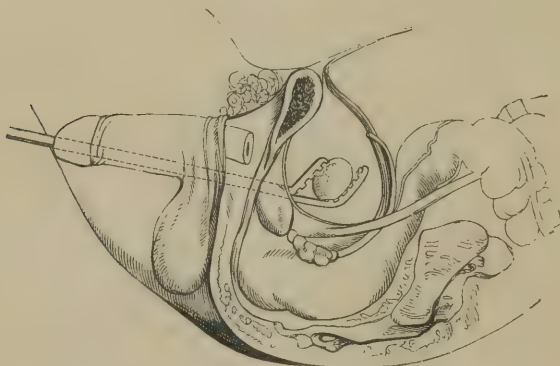
The object of this method is strictly to avoid giving any jerk to the instrument or to the bladder; and by barely coming in contact with its interior, no pain or contraction of the bladder is provoked. The same object was sought to be attained by the other method, simply by *not moving* the instrument in the bladder for the purpose of exploring to ascertain the situation of the stone; but by resting the instrument in contact with the interior of the bladder, to make the stone fall into its blades.

Coulson seems to combine *both* these methods in using the lithotrite; a slow twirling revolution of the instrument on its own axis, between the thumb and finger, without changing its central direction; and at the same time, a gentle sliding motion of the male branch backwards and forwards to the extent of half or three-quarters of an inch—thus gently raking or traversing the floor of the bladder on either side successively.

Of these three methods of using the lithotrite, I prefer the latter.

*Crushing the Stone.*—When once firmly fixed between the blades of the lithotrite, the stone is to be crushed into fragments. It is raised to the centre of the bladder, so that the mucous membrane shall not be injured by the splintering of the stone. (Fig. 448). Crushing may first

FIG. 448.



be attempted by pressure with the hand alone, without the action of the screw. The female branch is held firmly by the left hand, applied to the square portion; the circular projection immediately behind is embraced between the index and middle fingers of the right hand, hooked on to it and used as a point of resistance; the expanded extremity or wheel of the male branch rests in the palm of the same hand turned upwards and forwards. In this position, by strongly and repeatedly contracting the fingers towards the palm, the male branch is slowly and cautiously driven forwards on the stone, which is distinctly felt to break-down. A small stone may thus be easily crushed. When this manipulation fails, the screw must be brought into action. Still holding the female branch firmly with the left hand, the handle of the screw is held between the thumb and fingers of the right hand, and the screw worked gradually from left to right; thus propelling the male branch forwards on the stone. If the key-handled (screw) lithotrite be used, the handle is held between the

fingers of the right hand, backwards, as in drawing a cork with a cork-screw; and worked also by a number of short and sharp turns of the wrist. The annexed figure shows the instrument in action, as held and worked by Sir William Fergusson, in recent years. (Fig. 449.)

In either mode of crushing, by hand-pressure or screw-pressure, the male branch must be sent home into the female branch, so that the blades

FIG. 449.



come together. This object is known to be attained by observing that the entire length of the screw passes down the lithotrite. Then the instrument can be safely withdrawn.

The fragments must be got out of the bladder as soon as possible, but not by a prolonged use of the instrument; lest in removing one source of irritation and inflammation, another be substituted. The crushing should not be repeated, unless the stone is small and friable and can easily be reduced at once. This first sitting should be short, not exceeding five minutes.

Detritus can be removed amounting to a considerable quantity, and containing some not insignificant fragments. For this purpose, the bladder should be washed out with tepid water, injected through a large-sized and large-eyed catheter. By repeating the injection three or four times, the fluid drawn off at last ceases to contain any detritus. Sir H. Thompson, usually, does not wash out the bladder.

*After-treatment.*—The patient should lie in bed, recumbent, for twenty-four hours, and not be allowed to stand or stoop forward in passing water, lest fragments might fall against or lodge on the neck of the bladder, greatly increasing the risk of irritation. Diluent drinks will promote the discharge of the detritus. In elderly persons with enlarged prostate, Sir B. Brodie recommends that the bladder should be washed out daily.

Subsequent sittings will be required to crush the fragments. Intervals of from three days to a week should elapse; when the operation may perhaps be prolonged to ten minutes at a time, as the bladder becomes accustomed to the instrument, or its irritability subsides with the gradual removal of the calculus. Generally from three to six sittings must be allowed, before all the fragments can be safely crushed.

In performing these after-crushings, Civiale's lithotrite with no slit in the female blade, is very serviceable for breaking-down and removing fragments; the instrument being withdrawn charged with more than detritus. Fragments of rather large size may thus be extracted safely through the urethra. Having seized a fragment, the size of which may be estimated by observing the separation of the blades as indicated by the length of screw exposed at the handle of the instrument, the fragment is

drawn to the neck of the bladder; when by a sort of slight pulling jerk with the instrument, the practicability of easily extracting it through the urethra can be ascertained. The bladder is washed out, to remove smaller particles. This procedure of fragment-extraction I have seen practised by Sir W. Fergusson. It seems preferable, however, to crush all fragments, and allow the detritus to escape per urethram; according to the method of Sir H. Thompson.

A *final* exploration of the bladder is made to determine the complete removal of every fragment; any one remaining portion would form the nucleus of a recurrent calculus.

Certain *difficulties* are liable to occur in the performance of lithotripsy. They may be sufficiently anticipated and overcome by due attention to the directions given respecting the operation. Excessive sensibility and irritability of the bladder, enlargement of the prostate, and the impaction of angular fragments of stone in the urethra; may thus severally be managed.

*Dangers of Lithotripsy.*—These are referable to the state of the bladder and kidneys, induced by the operation.

*Hæmorrhage* happens, sometimes, to an inconvenient amount for the free working of the instrument; though rarely to a dangerous extent. In the 115 cases operated on by Sir B. Brodie, he did not meet a single example of serious loss of blood from the urinary organs. It was, however, so copious as to necessitate immediate recourse to lithotomy, in a case operated on by Mr. Key; and a patient at the Hôtel Dieu, in 1832, died of hæmorrhage from the bladder.

*Cystitis*, acute, or more frequently chronic, ensues in some cases. This is usually the consequence of prolonged lithotripsy.

*Atony of the bladder*, occurs chiefly in old persons. The patient enjoys too quiet a state of the bladder after operation, the urine being retained with ease for several hours, owing to the loss of expulsive power. Chronic cystitis is very apt to supervene by retention of urine, in this deceitfully tolerant state of the bladder.

*Spasmodic* retention of urine sometimes follows the operation, and it occurs mostly in combination with an atonic state of the bladder. Both are most frequent in old persons, with enlargement of the prostate. The treatment of the spasmodic retention consists in giving a warm bath and then a full dose of opium. In either case, the urine must be drawn off with a large-sized catheter, rather than allow any accumulation in the bladder.

Retention from the impaction of coagula or a fragment in the neck of the bladder must be treated by catheterization.

*Suppression of Urine* is an occasional consequence of the operation, and probably depends on some previously existing latent disease of the kidneys.

The *constitutional disturbances* incident to lithotripsy may be comprised under rigors, and febrile attacks, including pyæmic infection. *Rigors* not unfrequently occur immediately after the operation, especially after the first sitting; and last perhaps for some hours. This attack is most common and severe when the operation has been prolonged, and not at all in proportion to the amount of pain. A full dose of opium, or a tumbler of warm brandy-and-water, as Sir B. Brodie recommended, are the best remedies; the patient lying in bed and wrapped in a blanket. Irritative *fever* may ensue, which rapidly assumes a typhoid character; the pulse rising in frequency to beyond what can be distinctly counted, and becoming proportionately feeble and irregular, with a dry hot skin, and dry, harsh, brown tongue. This attack is more surely fatal than the most



severe rigors. *Pyæmia* occasionally supervenes, probably in connexion with suppuration as the result of damage done to the bladder. Pre-existing disease of the kidneys attended with albuminous urine, always tends to induce these unfavourable or fatal constitutional consequences of lithotritry.

Their treatment mainly comprises the administration of opium and stimulants, judiciously regulated.

*Results of Lithotritry, and, as compared with Lithotomy.*—Unquestionably the accumulating results of experience in lithotritry lead to the conclusion that a far larger proportion of cases can fairly be submitted to this method of treatment than was formerly supposed, instead of to lithotomy. When first practised in this country, the results of Sir B. Brodie's 115 cases showed a mortality of somewhat less than 1 in 12½; whereas the mortality of lithotomy is about 1 in 7, or even as high as 1 in 4½. Civiale's cases of lithotritry in one year—1862, amounted to 45, about his annual average. Of these, 8 were partially cured; and the operation was successful in all the remaining 37, but 1. The same distinguished lithotritist states that his total mortality in 591 operations, was 14 deaths, or only 1 in 42.21. But this general result has been much criticized. Sir H. Thompson has been very successful; his cases having been more clearly recorded. From an Analysis of 184 consecutive cases of lithotritry in the adult; it appears that the recoveries, reckoning every kind of casualty following the operation, were 93 per cent.; but, omitting 5 cases of death from other causes, the mortality amounted to only 4 per cent. Mr. Crichton has performed lithotritry in 122 cases with only 8 deaths, or less than 1 in 15. Mr. Charles Hawkins has collected the results of all the cases of stone in the bladder admitted into the London Hospitals (excepting the Hospital for Stone), in the years 1862-63. The total number of patients was 177, comprising 86 children and 91 adults; of the whole number it would appear that only 32 were treated by lithotritry, while 139 underwent lithotomy—the remaining 6 cases not having been submitted to either operation.

Considering the relative mortality of the two operations—so highly in favour of lithotritry; the small proportion of cases submitted to this operation would scarcely seem judicious. At the Royal Free Hospital, it is true, the 7 cases of stone in the two years, all underwent lithotomy; but then they were all cases in children.

**SELECTION OF OPERATION.**—**LITHOTOMY OR LITHOTRITY.**—The practical importance of a judicious selection of cases for either operation is well enforced by Civiale's statistical results, in regard to all the calculous patients on whom he operated, in one way or the other, during a period of twenty years. The total number being 838 cases of stone in the bladder; only 548 were fit cases for lithotritry, 290, or more than one-third, were not operated on by this method; and of the last 332 cases included in this list, 241 were lithotritized, leaving 91 which were considered unfit for that operation. Of the 91 cases; 28 were lithotomized, and in 8 others the two operations were combined, making a total of 36 cases subjected to lithotomy; and of which, Civiale lost 18, or exactly one-half.

The *conditions* which determine the fitness or applicability of lithotritry, are:—(1) The state of the urinary organs, and of the bladder and kidneys in particular; (2) the general health of the patient, and as connected with age; (3) the nature of the calculus—as to size, density, shape, situation, and number.

When the bladder is healthy, and the kidneys free from disease, especially with regard to albuminous urine; the general health not deteriorated; and the stone small, and friable; all the conditions concur in favour of lithotripsy. The opposite conditions are, of course, unfavourable in a greater or lesser degree.

(1) The conditions of the *urinary organs* relate to the bladder, kidneys, prostate, and urethra. As more or less unfavourable may be mentioned; an irritable or inflammatory state or tendency of the bladder, or an atonic state, or an hypertrophied bladder of diminished capacity. The latter state is not unfrequently associated with extreme irritability of the bladder, thus further contracting its cavity. Chronic cystitis and especially of a purulent character, is a more unfavourable condition for operation, than acute cystitis; which is also comparatively rare. Disease of the kidneys of a nephritic or degenerative character, attended with morbid states of the urine, are specially unfavourable. Hence, casts of the tubes or blood in the urine, and the appearance of albumen to any extent, as persistent albuminuria, contra-indicate the performance of lithotripsy. Enlargement of the prostate is in *itself* only a mechanical objection to the operation; the stone often being lodged in a depression behind the enlarged gland, and not easily accessible to the lithotrite. Enlargement of the middle lobe more especially, diminishes the capacity of the bladder, deepens its floor, and tends to conceal the stone in a cavity behind the gland. But an enlarged state of the prostate is often associated with an unhealthy state of the bladder, and occurs mostly in advanced life. Stricture of the urethra, or an irritable state of the passage, will also obstruct the introduction of the lithotrite, and retard the discharge of detritus.

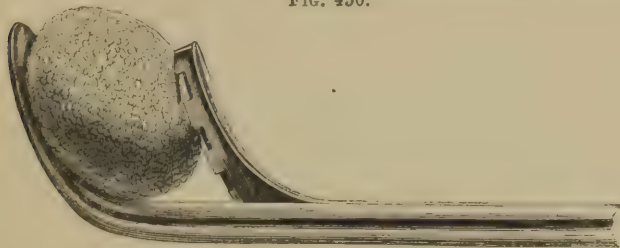
(2) The conditions of the *general health* which are unfavourable for lithotripsy, cannot be clearly defined; they comprise chiefly a deranged state of the digestive organs, with loss of flesh and strength; nervous depression; and recurring febrile attacks. But, in the 184 cases operated on by Sir H. Thompson, "many" of the patients were of "very feeble health and constitution."

*Age* is significant in its relation to the accompanying state of the bladder and the health of the patient. In *children*, the diameter of the urethra is small; the antero-posterior diameter of the bladder is short; the organ is irritable, and its neck is very dilatable, a peculiarity which favours the impaction of the fragments; while the indocility of the child is a great difficulty in performing lithotripsy, especially when repeated sittings are necessary. This latter difficulty can be overcome by chloroform; but the undeveloped condition of the genito-urinary organs before the age of puberty, renders the operation neither an easy nor a safe one. On the other hand, lithotomy is singularly successful. Nevertheless, if lithotripsy diminishes the mortality in adults, it should, as Mr. Coulson observes, have a still greater influence in reducing the comparative mortality when applied to children; in whom the urinary organs are in a healthy condition, and because the number of deaths in adults, after crushing the stone, is greatly increased by the state of the urinary organs at that period of life. Sir W. Fergusson, Mr. Curling, and other Surgeons in the London Hospitals, have performed lithotripsy in children, and with not unfavourable results. In *advanced periods of life* and old age, the irritable state of the genito-urinary organs forbids lithotripsy. Exceptional cases of successful results have been met with; Segalas having lithotripsy 14 octogenarians, without losing one; and 27 septuagenarians, with the loss of only two. Of

Sir H. Thompson's 184 cases; the mean age was no less than sixty-one years; forty-six were seventy years, and upwards; the oldest was eighty-four years; whereas, only three were below thirty years, and the youngest was twenty-two years old. Lithotomy, on the other hand, is very fatal in aged persons, and very successful in children.

(3) The *calculus* itself has an important influence with relation to lithotritry, more than to lithotomy. A *large* stone is unfavourable for crushing, owing to the number of fragments in the bladder and the continued discharge of detritus through the urethra, and the necessity for a more repeated performance of the operation. The bladder should be proportionately healthy, a condition not often co-existing with a large stone. From Sir H. Thompson's large experience, it appears that a stone about the size of a *date* or *small chestnut* (Fig. 450), and corresponding to somewhat less

FIG. 450.



than an *ounce* in weight; is always suitable for lithotritry; all stones of an ounce weight, and upward, being reserved for lithotomy. A stone of this size, and weight, may be easily discovered by sounding. In Sir H. Thompson's practice, lithotritry has never proved fatal, when the stone was no larger than a small nut; but, the rate of mortality corresponds with the increasing size of the stone, above that of a small chestnut. A *hard* stone yields sharp, angular fragments, very irritating to the bladder. A large and also hard stone may be said to contra-indicate lithotritry. But a soft or friable stone, even of large size, is not an unfavourable kind of calculus. Hence, the chemical nature of the calculus has some relation to lithotritry; certain uric acid calculi which ring when struck with the sound, and oxalate of lime or mulberry calculus, are not readily crushed; whereas phosphatic calculi are easily broken-down. The different consistence of the two latter kinds of calculi, in their relation to lithotritry, is however, a consideration more than counterbalanced by the state of the urinary organs; in the oxalic acid diathesis, these organs being comparatively healthy; in regard to phosphatic calculi, equally unhealthy.

The remaining peculiarities connected with stone in the bladder, present mechanical difficulties chiefly, as relating to the selection of the operation,—lithotritry or lithotomy. Thus, the *irregular shape* of a stone offers a difficulty in seizing it with the lithotrite. But similar difficulty is experienced in seizing with the lithotomy-forceps, and there is the additional difficulty of extraction. The *situation* of a stone may render it inaccessible; as when lodged in a pit behind an enlarged prostate, above the pubes, or encysted anywhere in the walls of the bladder. It may then be almost equally hard to get at in either operation. A *single* stone is more suited than several calculi to the performance of lithotritry, and



of lithotomy also. But the time necessary for the operative procedure of crushing must be taken into account. The presence of several calculi is not unfavourable for the operation of lithotripsy, provided only they be small and soft. Civiale has thus operated with success in a case where the bladder contained 40 calculi.

The *chemical composition* of calculi submitted to lithotripsy, has varied; all kinds of calculi having been crushed, but perhaps, chiefly those of uric acid and the urates. Thus, of Sir H. Thompson's cases; 122 were uric acid, and the urates; 16 were mixed; 40 phosphatic; 4 oxalate of lime; 1 pure phosphate of lime, and 1 cystic oxide.

RECURRENCE OF STONE.—After lithotripsy, a recurrence of calculus in the bladder is far more frequent than after lithotomy. In Civiale's practice, this has happened about once in every ten cases. Of 36 patients on whom he performed lithotripsy in 1860; 10 had been previously operated on, and stone had returned. But of Sir H. Thompson's 184 cases, a second operation for recurrence, was performed in only 13 cases. In no instance, however, was an operation of lithotripsy completed by lithotomy.

Recurrence must arise from some fragment having remained in the bladder, which formed the nucleus of another calculus. Hence, the practical importance of carefully searching the bladder at the last; the final exploration or sounding, to which I have already alluded. If a small fragment can escape detection in such practised hands as Civiale's, less experienced lithotritists should be far more guarded in completing a case.

Irritability of the bladder, remaining for a long time, is a not uncommon sequel of lithotripsy; itself successful. This never occurs after lithotomy; the bladder having been relieved of the stone, as the source of irritation, recovers its tone completely.

*Treatment.*—Whether after lithotripsy or lithotomy, a secondary calculus must be removed. Which kind of operation should be repeated,—crushing or extraction, must be determined by the conditions already mentioned with regard to the selection of these operative procedures. Secondary lithotomy may be performed through the track of the former wound; care being taken to avoid the rectum, which is somewhat drawn up and adherent to the membranous urethra and prostate. Right lateral lithotomy may be performed, as Liston suggested, provided the Surgeon be ambidextrous. The median operation offers an available resource in these cases.

PROSTATIC, and URETHRAL, CALCULI, are more conveniently noticed in connexion with Diseases of the Prostate Gland, and of the Urethra.

CALCULUS IN THE FEMALE.—Stone in the bladder is not of common occurrence in women, though not very rare. In 146 cases of stone operated on at St. Thomas's Hospital, during a period of twenty-three years; South states that 144 were males, and only 2 females, giving a proportion of 1 female to 72 males. This is greatly below the average. Crosse, at the Norwich Hospital found the proportion to be 1 female to 19 males. In France the average was higher; 1 to 22. But in Italy, Civiale finds the average to be 1 to 18; which may probably be taken to represent the general average. Coulson puts the proportion, among those who are submitted to operation, at about 1 female to 20 males. The probability is that stone forms more frequently, than it is found, in the female bladder. This seems owing to the peculiar anatomical conditions of the urethra, which facilitate the escape of a small calculus. The urethra is short, almost straight, of large size and readily dilatable, without any natural

contractions in the canal; and there is no prostate gland at the neck of the bladder. Thence, a stone may form in the bladder, but more easily escape through the urethra.

*Symptoms.*—In addition to the usual symptoms of stone in the male bladder, and the sure sign afforded by sounding; two special symptoms occur in the female. These are, bearing-down pains and pains along the urethra, and incontinence of urine,—a tendency to constant dribbling or wetting. Irritability of the bladder, from any of its various causes, or a vascular urethral tumour, may give rise to similar symptoms; but sounding will determine the diagnosis.

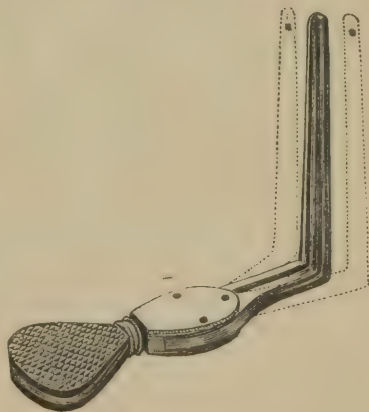
The consequences of persistent calculus are also peculiar; it may be discharged through the vagina, by an ulcerative communication through the bladder and the vagina, forming a vesico-vaginal fistula; or the stone may impede the descent of the foetal head in birth, as a rare cause of difficult parturition. I once saw an instance of this kind in the Royal Free Hospital; a woman died after child-birth, and a stone was found in the bladder, the size of a hen's egg, consisting of phosphates encrusted with carbonate of lime.

*Treatment.*—The various operative procedures for removing calculi from the female bladder, are of four kinds:—(1) Dilatation of the urethra; (2) Dilatation, with partial slitting up, of the urethra; (3) Lithotripsy; (4) Lithotomy, practised in four different ways.

*Dilatation of the urethra* may be accomplished rapidly, or slowly; the former method was recommended by Sir A. Cooper when the stone is *small* and that dilatation should be accomplished in a few minutes; but that when the stone is *large*, it will be better to dilate slowly and gradually from day to day, until the requisite extension is accomplished. Rapid dilatation is not much more painful than the slower; but, according to Dupuytren's experience, it is much more likely to be followed by *incontinence* of urine. Dilatation can be effected by various means; solid or flexible bougies, gum-elastic catheters, prepared sponge, or other tents; or by the cautious application of Weiss's female urethra dilator,—a two-bladed instrument, worked by a screw at the handle (Fig. 451), the speculum, or blunt gorget. After sufficient extension, a pair of forceps is introduced and the stone extracted. In one case I succeeded with forceps alone in extracting an oxalate of lime calculus, the size of an almond, which was impacted in the urethra of a young woman. The stone had been lodged there for some time, causing partial retention of urine; and when removed, its exposed surface was obviously "water-worn," by constant attrition of the stream of urine in micturition.

*Dilatation, with partial slitting-up of the urethra*, is an applicable procedure when the former method has been carried to the farthest

FIG. 451.



extent consistent with safety; and yet the stone is too large for extraction without thus dividing the urethra. This method is described by Ambrose Paré, who saw the elder Collot perform the operation. A grooved staff was introduced into the urethra, and on it a small incision was made vertically *upward*. Sir B. Brodie revived this operation, and divided the urethra directly upwards under the symphysis pubis. Dilatation was then made with Weiss's instruments, to a sufficient extent for the introduction of the forceps and extraction of the stone. The objection to the upward incision is that it necessitates extraction of the stone where the space is most restricted.

The *direction* of the incision has been varied by Surgeons; some cutting directly down, some obliquely down, and others sideways.

*Double* incision of the urethra, combined with dilatation, was proposed by Dionis; the urethral orifice being divided horizontally on both sides. In these operative procedures by urethral incision, the vagina is necessarily involved, when the incision is downwards, or even oblique. The probability of incontinence of urine resulting from the urethral incision, rather than from dilatation alone, seems doubtful; Surgeons of great experience holding directly opposite opinions on this important issue.

*Lithotrity* is preferable to either of the above methods, urethral dilatation, or with incision combined, when the stone is of *large* size. This operation is far more easily performed in the female than in the male; and it is frequently more successful in its results; both these advantages having reference to the peculiar anatomical conditions already mentioned.

*Lithotomy* is also more readily performed than in the male, and it may be done in either of *four* ways.

The patient is placed under chloroform, and tied up in the position as for the operation in males; and a grooved staff is introduced into the urethra, which is hooked up perpendicularly under the symphysis pubis. A common bistoury, lithotomy-forceps, and scoop, are the only other instruments required.

(1) *Urethral* lithotomy is nothing more than incision of the urethra, carried up the passage, so as to divide also the *neck* of the bladder. Dilatation is then made sufficiently to allow of the completion of the operation, by extraction. The *lateral* operation,—analogous to that in the male, is most frequently performed. A straight staff having been introduced into the bladder, its groove is directed downwards and outwards towards the ramus of the ischium, and the urethra divided obliquely downwards with a probe-pointed bistoury. This incision often intersects a small portion of the anterior wall of the vagina. Chelius has recommended a vertical incision directly downwards, thus dividing also the corresponding wall of the vagina. A bilateral section of the urethra has also been performed. Liston notched the neck of the bladder on both sides towards each ramus of the pubes, and then dilated for a few minutes until the finger could pass into its cavity.

(2) *Direct* lithotomy has also been performed, as suggested by Celsus. This method of “cutting on the gripe” in women, consists in passing the fingers into the vagina, in order to press the stone forwards against the neck of the bladder, and then making a transverse incision directly on the stone between the urethra and symphysis pubis. Lisfranc endeavoured to revive this method, in 1823; but it has justly fallen into disuse.

(3) *Vagino-vesical* lithotomy consists simply in making an incision through the vagina into the bladder, and thence extracting the calculus.



A curved staff is used so that its convexity shall appear in the anterior wall of the vagina, while the posterior is depressed with a blunt gorget or a speculum. In this method of operation the urethra is avoided, and afterwards a female catheter is introduced through this passage into the bladder, and the edges of the vaginal incision are brought together by suture. Vidal has thus operated in 30 cases without any death; there is generally no hæmorrhage, nor subsequent peritonitis; but vesico-vaginal fistula is a common result.

Incontinence of urine is apt to follow all these operations of lithotomy.

(4) *Supra-pubic* lithotomy has been recommended in the female, as an occasional resource.

SOLUTION OF STONE in the bladder has been proposed and tried by means of various solvent agents; taken internally, or injected into the bladder.

Of the *constitutional* remedies, alkalies chiefly have been tried; such as liquor potassæ, the bicarbonates of soda and potash, and the borate of soda. The Vichy and other mineral waters have been resorted to as solvent remedies. On the other hand, acids have been administered to dissolve certain calculi. Thus, uric acid calculus might yield under the influence of alkalies; while oxalate of lime, and the phosphatic calculi, would perhaps be amenable to the mineral acids, nitric and hydrochloric. These supposed remedies have been taken diluted during a prolonged course of treatment, but with little or no effect, otherwise than the relief of calculous symptoms. Their efficacy as “lithontriptics,” seems very doubtful.

The *injection* into the bladder of diluted alkaline or acid solutions, has also been tried; and with more successful lithontriptic effect. Unfortunately, however, the solution if strong enough to be of any use, endangers the coats of the bladder; and when sufficiently diluted to avoid this danger, any solvent action on the stone is very uncertain. Injection has proved most effectual in regard to phosphatic calculi; Sir B. Brodie having shown that they may be greatly reduced in size, or dissolved entirely, by means of a weak solution of nitric acid,—two or two and a half minims of strong acid to the ounce of distilled water. Dr. Hoskins employed a weak solution of acetate of lead,—one grain to the ounce, with a mere trace of free acid.

*Electrolysis*, or the dissolution of stone in the bladder, by the transmission of an electric or galvanic current, has had its advocates. Sir W. B. O'Shaughnessy, Dr. Bence Jones, Dr. L. Melicher, and Gruithuisen, have severally attempted this method of treatment.

---

## CHAPTER LVIII.

### DISEASES OF THE BLADDER.

THE Bladder is liable to Diseases, not differing in their nature from those of other organs; but which present modifications in their pathology and symptoms, and thence in their treatment. Thus, inflammation known as Cystitis, acute and chronic, and various Morbid Growths or Tumours, may

affect the bladder; but the Malformations of this organ are peculiar; and its Functional Conditions are partly special in their character; such as frequent micturition, retention of urine, incontinence or involuntary escape of urine, and engorgement with overflow of urine. These conditions may also be symptomatic of the diseases referred to, which involve structural alterations in the bladder.

*CYSTITIS—Acute.—Structural condition.*—The seat of inflammation affecting the bladder is primarily the mucous membrane; occasionally, in consequence of the intensity or duration of the process, the sub cellular tissue and the muscular or middle coat may secondarily become involved; but the inflammation never occurs in the middle, and outer or peritoneal investment, independently of the mucous membrane. The portion of this membrane situated about the neck of the bladder, is most commonly and severely affected; extending thence to the whole of the lining membrane. After death, the membrane is found injected and reddened in specks and patches; or it may have assumed a greenish slate colour, or a chocolate tint, when the inflammatory condition has been of some duration. Occasionally, lymph-effusion takes place on the surface of the mucous membrane; forming shreds or patches of lymph, or even a false membrane slightly adherent to the whole interior of the bladder. Very rarely, this membrane has been known to cause retention of urine, necessitating puncture of the bladder; and I remember the late Dr. Robert Knox to have told me that, in Edinburgh, he had seen a membranous vesical cast of this kind drawn out of the bladder by supra-pubic puncture. In the female, it is sometimes thrown off entire.

*Symptoms.*—The essential symptoms of acute cystitis are:—severe pain and sense of aching weight in the region of the bladder above the pubes, extending down the urethra into the perineum and down the thighs; this pain is accompanied by a frequent, urgent and soon intolerable desire to pass the urine, which is expelled at short intervals, in small quantities, by spasmodic straining efforts. These symptoms are those of simple irritability of the bladder, in an extreme degree. But the contracted bladder, forming a small, round, and firm tumour, is exceedingly painful on slight pressure over the pubes, or when touched or tilted with the finger through the rectum; and the character of the urine also,—high coloured and acid, mixed with mucus or pus, and perhaps tinged with blood, indicates an inflamed state of the vesical mucous membrane. The symptomatic inflammatory fever or constitutional disorder is often severe.

Cystitis usually commences suddenly and runs a rapid course; or it may supervene on the chronic form of the disease.

*Causes.*—Acute cystitis is commonly the consequence of an extension of inflammation from adjacent parts; most frequently from the urethral mucous membrane, by gonorrhœal inflammation extending backwards to the neck of the bladder, in retrocedent gonorrhœa, or more severe inflammation may have extended from the prostate, the rectum, or the kidneys. Injuries, such as blows and pelvic fractures, operations of lithotrity, prolonged catheterism, injections, and lithotomy; in the female, prolonged and instrumental labours; also the mechanical irritation of calculus; the chemical action of cantharides, and of some mineral poisons, and strong diuretics; or the action of the urine itself, retained and decomposed, as in stricture and prostatic enlargement. The disease arises also occasionally from gout, or from exposure to cold.

*Terminations.*—Resolution; or the disease may subside into the

chronic form; suppuration in the wall of the bladder, leading to peritonitis, or between the bladder and rectum, followed by urinary infiltration in the cellular tissue of the pelvis or of the perineum; ulceration, or gangrene of the mucous membrane, in the worst cases.

*Treatment.*—Remedial measures consist in derivation, diluents, and alkalies to render the urine unirritating, and the influence of opium. Thus, perfect rest in the recumbent position will relieve the bladder of the whole weight of the upward column of blood; while leeches, warm fomentations and hip-baths, will aid this derivation. Laxative aperients, such as castor-oil, preceded by a dose of calomel at the beginning, will also derive from the bladder and keep the bowels free from irritation. Diluent drinks, such as barley-water, should be liberally allowed; and the citrate or nitrate of potash, largely diluted. Opium may be advantageously administered in the form of enemata, or suppository, thus allaying the distressing vesical irritability; while the continued influence of opium taken internally, tends to subdue pain and inflammation.

If cystitis be the consequence of *retrocedent gonorrhœa*, the return of urethral discharge should be solicited by warm fomentations to the penis or wrapping it in a poultice. When the urine is acid, and its sediment yellowish and not coherent but purulent; Sir B. Brodie recommends a pill of calomel, two grains with half a grain of opium, to be taken twice or three times a day. When the urine is alkaline, and presents a small quantity of brownish adhesive mucus; the same authority advises the vinum colchici to be given in fifteen minim doses, thrice daily for three or four successive days.

Cystitis resulting from *cantharides* locally or internally absorbed, comes on usually within two to four hours after the dose; the symptoms soon reach their maximum of intensity, and subside in from six to twelve hours. Bicarbonate of potash and full doses of hyoscyamus, should be given every half-hour for three or four hours, and perfect rest enjoined. If a blister has been the cause, it must be removed at once, and the surface thoroughly sponged free of every particle of cantharides.

*Chronic cystitis.*—This form of the disease presents two varieties; inflammation of the vesical mucous membrane, with very slightly increased secretion, or with an abundant secretion of muco purulent matter. The one condition is *simple* chronic cystitis; the other is known as *catarrh* of the bladder or cystorrhœa. In both varieties, especially the catarrhal, the mucous membrane has become thickened, velvety, and of a dark colour; the vessels being injected or congested, and the muscular coat somewhat hypertrophied.

*Symptoms.*—The same symptoms are presented in both states of chronic inflammation; and modified only in degree from those of acute inflammation. But chronic catarrh of the bladder is distinguished by the discharge of thick, tenacious, grayish muco-purulent matter in the urine, in greater or less abundance, and which gradually subsides to the bottom of the vessel in which it is collected. Under the urine, it appears as a semi-transparent, whitish, tenacious jelly, something like parboiled white-of-egg; and on pouring off the urine, it hangs slightly adherent to the vessel, and then slides down suddenly in a lump; or it can be poured from the vessel in long coils, resembling maccaroni. This mucous deposit may be tinged with blood, or present white streaks of phosphate of lime. The urine itself becomes brownish, ammoniacal and fetid. A typhoid febrile condition accompanies this advanced state of the disease; the



pulse becoming extremely rapid and feeble, the tongue dry and brown, with great prostration and cerebral oppression.

*Causes.*—Acute cystitis may subside into the chronic or persistent form of inflammation. But chronic cystitis may also arise independently from any cause of long-continued irritation of the bladder;—from calculi and other foreign bodies, or tumours in the bladder; or from the retention and decomposition of urine; as in stricture of the urethra, or enlargement of the prostate, or in spinal paralysis. The latter disease is not only a cause of retention, it also induces an inflammatory state of the vesical mucous membrane by impaired nervous supply.

*Treatment.*—The same plan of treatment is appropriate as in acute cystitis, only modified in degree. It comprises derivation from the bladder, correction of an irritant state of the urine, and the influence of opium to allay pain and vesical irritability. But the abundant discharge of mucus or muco-purulent matter and the alkaline state of the urine, which especially characterize chronic *catarrhal* inflammation of the bladder, render certain special treatment necessary; to arrest the secretion from the mucous membrane and to correct the state of the urine. Pareira brava, a concentrated decoction, uva ursi, or the infusion of buchu, given with the mineral acids, are more or less efficacious; I much prefer the concentrated decoction of pareira with diluted nitro-muriatic acid in ten or fifteen minim doses. The acid is more suitable when the urine is itself alkaline, than when it subsequently becomes so by admixture with alkaline mucus in the bladder. Benzoic acid also renders alkaline urine acid, and I have found gallic acid useful in arresting the secretion of ropy mucus. Injections are highly serviceable, when no acute symptoms are present. They may be sedative, as tepid water or decoction of poppies, in quantities of not more than two ounces and retained for half a minute once a day; or astringent injections, as diluted nitric acid, ten minims gradually increased to twenty in two ounces of water. By these measures, coupled with tonics and a generous diet, to support the dread exhaustion of chronic cystitis, we may succeed in arresting the progress of the disease to a fatal issue. In conjunction with this course of treatment, the removal of any cause in operation must obviously be a primary consideration. Hence, the treatment for stone or other foreign body in the bladder, or perchance a tumour in this organ; and the various causes of retention,—stricture, enlarged prostate, or paralysis.

**TUMOURS OF THE BLADDER.**—These diseases comprise:—(1) Fibrous growths, of a warty or of a polypoid character; (2) Villous or vascular growths; (3) Cancer; encephaloid, scirrhus, or colloid.

*Fibrous growth* springs from the mucous membrane and sub-mucous tissue and consists of their elemental structures. It commences in the form of a circumscribed elevation of the mucous membrane, resembling a *warty* growth, and subsequently enlarges, protrudes, and assumes a *polypoid* form.

The *symptoms* are those arising from any cause of pain and irritation, with obstruction to micturition; and there is also the presence of a foreign body in the bladder. Simulating stone, careful sounding to discover the position and form of the growth may show distinctive characters. Phosphatic deposit encrusting the growth may, however, still mislead as to its true nature; but the fixed position, and impossibility of passing a sound around the tumour, free of the bladder, will determine the diagnosis.

This species of growth is most common in children and young persons. The absence of blood in the urine or in any notable quantity, distinguishes warty or polypoid growth from both the remaining species, villous growth and cancer.

The *treatment* is palliative, to allay pain and vesical irritability, with the use of a catheter when necessary. Polypus of the bladder has been removed in two cases; by Civiale with a lithotrite; and by Warner with a ligature, from the bladder of a female after dilating the urethra, the tumour being the size of an egg.

*Villous growth* springs also from the mucous and sub-mucous tissues, and consists of cellular elements and large looped capillaries. It presents in the form of innumerable fine villous processes or tufts, which branch off from the base in every direction. Floating in water, this growth appears as a soft, flocculent body, about the size of a large marble when fully developed. Several such tumours may co-exist, giving to the interior of the bladder a studded villous appearance. The structural identity of the villi with those of the chorion in a healthy state, is remarkable.

The *symptoms* are not peculiar, either with regard to obstruction or the presence of a foreign body in the bladder. But the pain and vesical irritability are much aggravated; and the abundant, foeturecurring draining hæmorrhage, or *bloody urine*, distinguishes this species of growth from polypus. Shreds of the tumour are also apt to appear in the urine, which examined by the microscope, will confirm the diagnosis.

The *treatment* is palliative as for polypus. Astringent injections may perhaps be used, as weak solutions of acetate of lead or nitrate of silver; and astringents taken internally, as gallic acid, may prove serviceable in arresting the tendency to hæmorrhage. Tonics, especially iron and quinine, with a nutritious diet, will be requisite to support the patient under the exhaustion resulting from long-continued pain, irritability of the bladder, and hæmorrhage. The introduction of any instrument must be avoided as much as possible; sounding is less effective in the diagnosis of a growth so soft and flocculent; catheterism aggravates the pain and irritation and may provoke bleeding; while, the removal of villous growth would be equally hazardous and ineffectual.

*Cancer* of the bladder is more common than the last named species of growth. It may be primary, commencing in the bladder; or secondary, extending from the prostate, the rectum, or the uterus. The species is most frequently *encephaloid*, and usually so when originating in the bladder, always of this kind when spreading from the prostate; *scirrhous*, when spreading from the rectum or the uterus, or epithelial cancer from the latter organ. *Colloid* is more rare; but in post-mortem examination, I have met with this species of cancer occupying the whole interior of the bladder, as a semi-transparent, greenish-yellow, trembling, mass of jelly; as if the organ were fully distended with urine. Similar colloid deposits were found in the uterus and rectum, and in most of the abdominal viscera.

*Symptoms*.—The pain of cancer in the bladder is very severe, but scarcely ever lancinating; and is referred to the lower part of the belly, to the loins, hips, thighs, and perineum. Vesical irritability is so active, that the urine is ejected every few minutes; and when ulceration of the mucous membrane ensues, it is expelled with sweating agony. The semen also may be emitted, and the contents of the bowel evacuated, or the bowel itself protruded, during the writhing effort to strain off the

last few drops of urine. Profuse, gushing *hæmorrhage*, or *bloody urine* and of an alkaline, fœtid, purulent character; with perhaps the appearance of cancer-cells in the urine; are tolerably distinctive of cancer-growth in the bladder. But the presence of a solid *tumour* in the situation of this organ at the lower part of the abdomen, is characteristic of cancer; excepting when a non-malignant growth has attained to such size as to occupy the bladder,—a rare event. Then the diagnosis will turn on the general severity of the bladder-symptoms, aided perhaps by the appearance of the cancerous structural elements in the urine. Constitutional symptoms, with glandular enlargements in the iliac regions, may supervene in an advanced stage of the disease; but the peculiar cancerous cachexia is even then not well marked. The patient's general health and aspect is that of a person worn down simply from pain, sleeplessness, and loss of blood.

*Treatment*.—Palliative measures only have any effect; comprising opiates, administered internally and sometimes by injection, tonics, and supporting diet. The disease is invariably fatal.

TUBERCLE of the bladder is a very rare affection; probably never occurring unassociated with tubercular deposit in other parts of the body, and of the urinary system especially; the kidneys and prostate in particular, being similarly affected. In women, it has been known to have followed primary disease in the uterus.

The *symptoms* are not peculiar, and the diagnosis is chiefly negative. Great pain, and extreme irritability of the bladder; with the absence of obstruction to micturition, and of a calculus or other foreign body, of hæmorrhage in any quantity, and of any perceptible tumour; together with the presence of tuberculosis, and progressive emaciation. These circumstances taken in conjunction with the patient's age, usually early or middle adult life, will indicate the nature of this disease.

When the tubercular deposit softens, the mucous membrane gives way, and a large ragged ulcer ensues, before death.

*Treatment* must have reference to the constitutional disease—tuberculosis, and the remedies for chronic cystitis.

HÆMATURIA.—Blood in the urine or simply bloody urine, is a *symptom* only of disease in some part of the urinary organs. Varying in quantity, from a small proportion discoverable only by the microscope, to an amount constituting the greater portion of the fluid passed; the admixture of blood and urine may be recognised by corresponding differences in the colour of the urine. When blood is present in small quantity, the urine has a brownish or smoky tint; and deposits a reddish-brown sediment on standing. In large quantity, the urine has a dark brown, muddy, colour, like chocolate; and deposits a red sediment adhering to the bottom of the vessel. Intermediate tints are met with, according to the admixture of blood. Heat coagulates the blood into a brownish-gray deposit, leaving a clear fluid above; and microscopic examination exhibits the characteristic red blood-discs. These tests, especially the latter, will show the presence of blood in the urine, and thus distinguish hæmaturia from simply dark reddish-coloured urine, due to other causes; bile, rhubarb, and other colouring matters, or to mere concentration of the urinary secretion.

The *source* of the blood in hæmaturia, and thence the seat of the disease, may be any one or more of the following parts; (1) the kidney; (2) the pelvis of the kidney; (3) the ureter; (4) the bladder; (5) the prostate; (6) the urethra.



*Causes.*—Diseases of the kidney, acute and chronic; injury, as blows, strains, etc.; calculus in any part of the urinary tract; violent diuretics, as turpentine or cantharides; cystitis occasionally; prostatic disease; cancer of any part of the urinary organs; villous tumour of the bladder; the hæmorrhagic diathesis; certain blood diseases, as fever, or purpura; stricture of the urethra; chordee; local application of mechanical and chemical agents.

The *diagnosis* of the source of blood in the urine is the same as of these causative conditions. But the general ground of distinction is this:—when hæmaturia is renal, the urine will be uniformly mixed with the blood; when it is vesical or prostatic, the first portion of urine that passes or that is drawn off by the catheter, will be pale and less bloody than the last, and at the termination of the stream, pure blood only may escape.

*Treatment* must always have reference to the cause of hæmaturia,—the disease whence the blood emanates. The general remedial measures are; rest, the recumbent position, and astringents. Gallic acid in particular, sulphuric acid, acetate of lead combined with opium, or Ruspini's styptic, may severally be administered internally; and cold also applied to the hypogastrium, perineum, or within the rectum by injection,—when the hæmorrhage proceeds from the bladder. I am in favour of ice-cold water enemata. The management of the blood collected in the bladder has given rise to a diversity of opinion. It is recommended that the coagulum should be broken up and withdrawn, by the introduction of a full-sized catheter to which a syringe is then applied. This disturbance of the clot would seem to be unnecessary and prejudicial. Its removal may reopen the vessels and renew the hæmorrhage, while the solvent action of the urine will most safely and effectually bring away the blood. Opium may succeed in controlling the urgent desire to micturate; and when absolutely necessary to relieve retention of urine, surgical interference can be resorted to.

**MALFORMATIONS.**—Congenital aberrations of development in regard to the Bladder are fortunately not very common; the misery any such condition entails necessarily precluding the unhappy individual from society. Probably, however, such cases are more numerous than was formerly supposed; as, since surgical attention has been directed to their relief, persons thus afflicted present themselves more frequently at Hospitals and in private practice.

Malformations of the bladder are of three kinds:—(1) absence of the organ, with certain abnormal deviations of the ureters; (a) their direct communication with the urethra, (b) with the rectum, (c) with the vagina; (2) co-existence of two or more bladders; (3) extroversion of the bladder, with corresponding deficiency of the anterior wall of the abdomen, exposing the posterior wall of the organ as a prominent projection.

*Extroversion* of the bladder demands more particular notice, this malformation being susceptible of relief.

With absence of the abdominal wall over the bladder, the pubic symphysis is sometimes absent also. The posterior wall and base of the organ are then pushed forward by the abdominal viscera, and form a prominence; the mucous membrane having a red, vascular appearance, and showing the orifices of the two ureters, whence the urine trickling down, perpetually moistens the surface. From beneath the lower margin, a short imperfect penis depends, which is flattened, as if cleft in the middle line into the urethra. At the root of the penis, a rudimentary prostate

exists, the ducts opening into the angle between the bladder and pubes. A pouch of integument below represents the scrotum, and contains the testes, with usually some hernial protrusion of the bowels beneath the extroverted bladder. Both sexes are liable to this malformation, but it occurs more commonly in the male. In the female, the generative function is not necessarily wanting. But in both sexes, the extroverted mucous membrane is very sensitive and readily bleeds; while the continual distillation of urine, producing excoriation of the parts beneath, and pervading the patient with a constant odour of stale and decomposing urine, renders his life a misery to himself and intolerable to others about him.

*Treatment.*—*Mechanical* contrivances have been made with the view of forming an artificial abdominal wall over the bladder to catch the urine as it flows; thus preventing excoriation and the urinous odour. An india-rubber bag may be fastened over the bladder for this purpose; but great nicety of fit and capability of adjustment to the various positions of the body, are requisite elements in any such contrivance.

*Plastic operations* have also been devised with the view of restoring the deficient abdominal wall, and thus closing in, or as it were, completing the bladder. An ingenious operation of this kind was originally performed by M. Adolphe Richard, in October 1853; it was founded upon one performed by M. Nélaton for a lesser degree of deformity,—simple epispadias, in the early part of 1852. Subsequently, in 1859, Pancoast of Philadelphia, introduced the use of two reversed flaps, taken from the sides of the bladder at the groins, and turned with the skin surface towards the bladder. In the same year, Dr. Daniel Ayres of New York, operated in two cases on the same principle; and the skin at the margin of the exposed bladder was dissected up and brought together by sutures over the raw surface of the reflected flap. Into this country, Mr. Timothy Holmes, was the first to introduce an important modification of the operation,—reversed and superimposed flaps taken from the *groins*, at the sides of the bladder; whereby a better supply of nourishment would be secured, from the recurrent branches of the common femoral artery, and thence the greater probability of union taking place. Mr. John Wood has completed the operation, in all its details, and has been the most successful operator.

The *operation* now consists of two stages; the first, to effect the closure of the upper part of the bladder; the second,—after an interval of about a month, to close in the lower part, and to form a prepuce and complete the urethra. Closure of the bladder is accomplished, by reflecting two triangular flaps of skin, one on each side of the exposed bladder, with their bases downwards, and attached to the skin of the groin at Poupart's ligament. The apex of each flap meets the other at the median line above the extroverted bladder, so that the raw surfaces exposed by lifting them are continuous at that point. The inner edges of the flaps are made close up to the bladder, and are brought together in the median line, and united by interrupted wire sutures. The penis may then be fastened down to the scrotum by a silver-wire suture passed through the frænum, to allow a free escape of the urine. The angles of the groin and umbilical incisions are then to be united by wire sutures. Completion of the urethra and the formation of a prepuce—according to Wood's operation—"consists in raising the whole front of the scrotum, together with the skin covering the lower side of the penis—going deep enough to include the muscular layer of the *dartos*—so that these tissues form a sort of bridge

of skin connected with the groin on both sides. This is then lifted over the penis, which the great extensibility of the parts permits easily to be done, and placed upon a bed or raw surface, prepared for its lodgment by turning down a collar or flap from the arched border of the bladder-covering above, and from the sides of the urethra and penis below, as far forward as the glans. A continuous thin wire suture holds the deeper or reversed flaps together, and a single line of interrupted sutures connects the transplanted scrotal structures to the border of the bladder-covering. The gap in the scrotal wall is afterwards easily closed in over the testicles by the great extensibility of the hinder part of the bag, which is left intact; the margins of the wound being brought together vertically by thickish wire sutures that will not easily cut out."

As to the *difficulties* of these plastic operations, Mr. Wood finds;—that in the first stage—or closure of the bladder, the chief difficulty arises from the hernia-like protrusion of the hinder wall of the exposed bladder by the action of the abdominal walls upon the contained viscera. In the second stage—that of forming the new prepuce and completing the urethra, the chief difficulty arises from the occurrence of erections in the imperfect penis, excited perhaps by irritation of the sutures; thus displacing the united parts, or rupturing the newly-formed adhesions, before sufficiently secure to resist tension.

*After treatment.*—The former difficulty referred to, is best obviated by *position* of the patient, after operation; a sitting posture, with the knees drawn up, tied together, and placed over a high bolster. This relaxes the abdominal and pelvic muscles connected with Poupart's ligament, completely, and also allows the urine to drain off by gravitation from the raw and adhering surfaces. Erections are most effectually controlled by continued *cold applications*, as by irrigation or ice-bags.

*Results of Operation.*—Richard's case was unsuccessful, death ensuing, in nine days, from peritonitis. Ayres' two cases were both successful. Mr. Wood records eight cases of operation (Med.-Chir. Trans., 1869), in none of which was there the slightest approach to peritonitis; and all recovered, except the first case, which terminated fatally, death however not resulting from the operation. The success of operation in curing or relieving the malformation, has been variable; sometimes a perfect result, sometimes a complete failure, sometimes a greatly improved condition.

FUNCTIONAL MORBID CONDITIONS.—The bladder is subject to functional morbid conditions, which may, or may not, involve structural alterations in the organ.

These conditions of function comprise:—(1) irritability of the bladder; (2) spasmodic action; (3) neuralgia; (4) paralysis; (5) atony; (6) frequent micturition; (7) incontinence or involuntary escape of urine; (8) engorgement of the bladder, and overflow of urine; (9) retention of urine.

The anatomical construction of the bladder has important relations to these various functional conditions of this organ. A brief notice of its structure will tend to elucidate their pathology.

The urinary bladder is essentially a hollow expansion of mucous membrane, continuous with that of the ureters above and the urethra below; the function of this membranous bag being simply to receive and retain the urine, as secreted by the kidneys and conveyed by the ureters; until convenience may permit of its discharge through the urethral passage of exit, from time to time. Accordingly, the external aspect of this receptacle is closely surrounded with bands of muscular fibres—the un-



striped variety—disposed, amid cellular tissues, in figure-of-8 spiral loops, running vertically, obliquely, and horizontally.\* These muscular bands are plentifully supplied with blood-vessels—the superior and inferior vesical arteries—with also some branches of the uterine arteries in the female—both of which are divisions of the internal iliac artery; they inosculate and issue in large plexuses of veins. The latter are situated chiefly at the neck, sides, and base of the bladder, and terminate in the internal iliac veins. Lymphatics accompany the veins in their course. Nerves are supplied, partly from the sacral plexus, itself derived from the spinal cord, and these nerves are also distributed on the base and neck of the bladder; but a large supply coming from the hypogastric plexus of the great sympathetic is distributed on the upper surface and remaining portion of the bladder, not supplied by the sacral plexus of nerves. The muscular bands, blood-vessels, lymphatics, nerves, and cellular tissue, together form a second layer or coat, superimposed on the “mucous coat,” in which the vessels and nerves ramify and terminate; while externally, this “muscular coat” is partially invested by a reflexion of the peritoneum, forming the “peritoneal coat.”

**IRRITABILITY OF THE BLADDER.**—This functional condition is denoted by *frequent micturition*, of a more or less painfully urgent character.

The healthy irritability or contractility of the bladder is the vital property of the *muscular bands*, in its middle coat. Stimulated by the urine accumulated in the bladder, they contract both vertically and transversely; and by their combined action—aided by the voluntary action of the abdominal muscular parietes compressing the viscera downwards on the bladder—the contents of the organ are expelled, as occasion may require. The pathological condition of undue or increased irritability is, therefore, immediately referable to the muscular or middle coat of the bladder; but the painfully urgent desire to evacuate its contents, results from a similar exalted sensibility of one or other systems of *nerves*, or may be referable to both.

Irritability of the bladder—thus a musculo-nervous functional condition of this organ—is itself a symptom only; yet it is one which has a wide-spread etiology, comprising both local and constitutional causes; the latter relating chiefly to morbid states of the blood, or of the nervous system, and connected frequently with various hygienic and social habits of life. Vesical irritability is, therefore, not merely a symptom which may be selected for the convenience of associating much valuable clinical experience pertaining to diseases, different in themselves. As a symptom, it may have also a valuable *etiological* significance, by leading to the discovery of latent disease in operation, in perchance some distant and previously unsuspected organ or part of the body; while the continued operation of any such disease, and thence its *prognosis*, may perhaps be determined by the persistence of the vesical irritability. Consequently, rational curative *treatment* can be brought to bear upon the disease, which has been thus indicated and estimated.

**Causes.**—The bladder has its nervous and vascular relations to surrounding organs, and to organs distant in the body—both in health and disease. This two-fold relation to other organs, through the medium of the nervous and vascular systems, is the key to the etiology of irritability

\* Original Dissections by J. B. Pettigrew. Museum Roy. Coll. of Surgeons; and, same authority, “On the Muscular Arrangements of the Bladder and Urethra,” &c. Phil. Trans., 1867.

of the bladder. But, the organ itself may be the seat of irritation, in disease of the bladder; or its contents may be the source of direct irritation, as by the presence of stone, blood, or morbid conditions of urine.

All the causative conditions of vesical irritability are conveniently arranged under two general heads:—

*Local causes.*—Diseases of surrounding organs which cluster around the bladder, may severally operate as causes of its irritability. The majority of these diseases affect the bladder through either its nervous or vascular relations with the organ diseased. But, some apparently act *mechanically*, in reducing the *capacity* of the bladder as a receptacle for urine; by pressure from a tumour of the rectum or uterus, or by displacement of the latter organ. Diseases of the bladder itself may sometimes act mechanically in like manner; by hypertrophy or thickening of the wall of this organ, or by chronic enlargement of the prostate. In either way, the capacity of the bladder being diminished, while the quantity of urine secreted and conveyed into it continues undiminished, or is perchance increased; a more frequent discharge of urine is necessitated—a more frequent micturition, and thus the phenomenon of vesical irritability will be established. Other organic diseases of the bladder, as cancer, may operate in part mechanically; but more especially, by inducing an exalted state of the *vital* property of *irritability* or contractility in the muscular coat of the bladder. Cystitis, in the acute stage of inflammation, being unattended by any notable thickening of the bladder, would seem to have a similar influence. So also morbid contents of the bladder; as various conditions of the urine, the presence of blood or of a stone.

The various local diseases which operate as causes of vesical irritability may be enumerated in connexion with the organs themselves, as follow:—(1) Habitual constipation and Diseases of the Rectum; principally—hæmorrhoids, fissured anus, inflammation of the rectum, stricture, cancer, abscess about the rectum, and fistula in ano; (2) Displacements and Diseases of the Uterus and Vagina; chiefly—prolapsus uteri, or vaginæ, acute inflammation of the uterus, cancer, fibrous tumour; (3) Stricture of the Urethra, organic, spasmodic, inflammatory; (4) Diseases of the Prostate gland; chiefly—chronic enlargement, inflammation, cancer, and other tumours; (5) Diseases of the Bladder; chiefly—hypertrophy, cystitis—acute and chronic, cancer, stone, hæmorrhage. Morbid conditions of the Urine, with Urinary Deposits, rank as local causes of irritability by their direct operation on the interior of the bladder; but as pertaining to Urinary Pathology, they are included under the second general heading.

*Constitutional causes.*—This great class of causes embraces, (1) morbid conditions of the blood, (2) those of the nervous system.

Morbid conditions of the *Blood* result from perversions of the blood-forming processes; (*a*) by mal-assimilation, primarily in the process of digestion, or secondarily in that of nutrition; (*b*) by mal-excretion, through the kidneys, skin, or liver. Diseases of the *organs*, severally concerned in these processes, give rise to the consequent blood-conditions; and they, in their turn, are manifested by corresponding states of the urine and urinary deposits; the whole constituting Urinary Pathology. In relation to irritability of the bladder; the organic conditions are remote causes, the urinary conditions are direct or immediate causes; while the blood-vascular system is the medium of communication. The chief

of the causative urinary conditions are; lithic acid and lithates; oxalates; and phosphates.

Morbid conditions of the *Nervous System* comprise diseases of the Nervous centres—brain, and spinal cord; and of the ganglionic centres of the sympathetic nervous system. Diseases of these central *organs*, and of organs generally, being severally connected through the nervous system, they may thence become causes of vesical irritability.

It thus appears that diseases of organs *distant* from the urinary bladder in the body, are brought to bear upon this organ, through the agency of the nervous and vascular systems; just as *local* diseases generally operate, in like manner, upon it. Hence, the wide-spread etiology of irritability of the bladder.

*Treatment*.—Remedial measures must of course have reference to any cause or causes in operation. The treatment of local causes will be found in the various sections of this work, as pertaining to Diseases of the Rectum, &c. But the treatment of constitutional causes, both from a remedial and preventive point of view, is a large and special subject, which is more fully considered under Urinary Pathology in my treatise on the Irritable Bladder, than would be possible within the limits of a general work on Surgery.

**SPASM OF THE BLADDER.**—This affection is said to be an involuntary, uncontrollable, and exceedingly painful contraction of the bladder, occurring from time to time; the cause usually being inflammation, stone, morbid growths, &c. Spasm, like irritability, is a symptom only, of which disease is the cause. I am disposed to regard both these symptoms as the same, but as differing in their degree of intensity; spasm representing excessive irritability, and an acutely painful urgency of micturition.

The *treatment* of this affection is that of cystitis, and the removal of any foreign body from the bladder.

**NEURALGIA.**—Excessive sensibility of the neck of the bladder is an occasional affection; unaccompanied with any apparent disease discoverable during life or after death. A correct diagnosis is very important; lest perchance stone in the bladder, or some disease of the organ be mistaken for neuralgia; or the worse error be committed, of attributing a merely neuralgic affection to some such organic cause.

*Treatment* must be conducted on ordinary principles; anodynes general, and topical by suppositories, with tonics, a well-regulated diet and state of the bowels, change of air, and other hygienic resources.

**PARALYSIS OF THE BLADDER.**—This condition of the bladder signifies a loss or impairment of the contractile power of its muscular fibres, by failure of the nervous supply to this organ.

The paralysis may be partial or complete, and the usual cause is some lesion of the cerebral or spinal nervous centres. Thus, it occurs in connexion with injury to the brain or spine; or from disease, as apoplexy, softening, or other structurally destructive disease. Sometimes, the paralysis seems to be dependent on functional conditions; as spinal debility induced by sexual excesses; reflex action from some adjacent source of irritation, as hæmorrhoids and after operations for their removal; the shock of injury; the result of fever; and the influence of certain medicinal agents, as belladonna, hyoscyamus.

These two classes of causative conditions have each an important characteristic. The *functional* causes of paralysis of the bladder have only a temporary effect; and the *structural* causes generally involve other



parts—they are not restricted in their action to local paralysis of the bladder alone. Such limited paralysis of the whole organ, producing retention of urine, or of its neck only, producing incontinence, is extremely rare; it is usually not a paralytic condition, but simply atony from over-distension.

*Treatment.*—Palliative measures consist in emptying the bladder from time to time, and in the treatment of chronic cystitis consequent on the paralysis and retention of urine. The urine must be drawn off, two or three times a day, by means of a full-sized catheter. It should be used gently, the bladder having lost its sensibility to pain when injury is inflicted, and the urethra being often in a lax state. Chronic cystitis should be treated principally by local means; injections of tepid water to wash out the bladder, followed by weak astringent injection. Curative measures must be directed to the restoration of innervation—the supply of nervous influence.

In chronic cases, not traumatic; strychnia, iron, arsenic, cantharides, and ergot of rye, may prove beneficial; while, of local agents; blistering, cold douches, and electricity, are the most promising.

ATONY, FROM OVER-DISTENSION.—It is highly important to observe the distinction between this condition of the bladder and paralysis. Unlike the latter condition, atony always arises from some organic obstruction—stricture or enlarged prostate, mechanically impeding the evacuation of urine, or from long-continued retention; thus overcoming the contractile power of the bladder, instead of arising from any failure of this power. The resistance offered to the passage of urine, or by its accumulation, is simply greater than the expelling force. Hence, a portion remains behind after each act of micturition, and this residual urine having amounted to twenty or even thirty ounces in quantity, it begins to expand the neck of the bladder; leakage takes place, when strong expulsive force is exercised or by relaxation of the sphincter during sleep. But the resistance prevails, and the contractile power is gradually more and more overcome by continued distension of the bladder; until the muscular fibres are over-stretched, and the cavity of the organ becomes proportionately enlarged. The bladder is in a permanently atonic, and enlarged condition.

*Treatment.*—Curative measures will consist in the removal of any cause of obstruction to the free passage of urine, and the prevention of its accumulation in the bladder. The urine should be regularly drawn off once or twice a day, in order to enable the muscular fibres to recover their normal condition of contraction and tone. By this mechanical relief, a more or less completely successful result may be produced. At the same time, the tone may then be reinforced by medical treatment; chiefly, by the stimulants of nervous action, general and local, employed in paralysis. Injections of cold water into the bladder, have a direct and marked beneficial effect.

Certain *modifications* of the function of *micturition* remain to be noticed.

FREQUENT MICTURITION—whether of an irritable or spasmodic character. This modification of micturition has been already noticed. I introduce it here merely as a standard of contrast with the following modifications of this function.

INCONTINENCE OF URINE.—An involuntary escape of urine differs from frequent micturition, which is of a voluntary, although painfully urgent character.

Incontinence may occur under two opposite conditions. In *children*, and only during sleep, when the voluntary power of retention is temporarily suspended, the bladder then emptying itself; in *adults* of all ages, from retention amounting to *over-distension*, a certain quantity of the urine then running off and leaving a quantity still retained, an event which may happen during sleeping or waking. An involuntary escape of urine in the adult, always indicates a *distended*, not an empty state of the bladder.

The *causes* of incontinence differ accordingly. In childhood, it generally arises from debility, or intestinal irritation; in adult life, its causes are those of retention—paralysis affecting the bladder, atony from over-distension, stricture, enlarged prostate, cystitis, stone. In the *female*, incontinence is generally the result of some injury to the urethra, impairing or destroying the action of the sphincter; such as sloughing from pressure in difficult labour, from the application of instruments in delivery, or from over-dilatation of the urethra for the removal of stone in the bladder.

The neck of the bladder may be the seat of *structural* disease, or malformation. The incontinence is then usually a *continual* dribbling, the urine running off from the bladder as fast as it arrives there from the kidneys. This condition, therefore, differs from both the ordinary modes of incontinence, in childhood or adult life. It differs also from frequent micturition; not only in its involuntary character, but in there being no distinct acts of micturition.

*Treatment.*—In *children*.—A general tonic plan of treatment is indicated, combined sometimes with sedatives. The vinum ferri is especially beneficial; and Sir H. Thompson speaks highly of the extract of belladonna; commencing, according to the age of patient, with the sixteenth to the eighth of a grain twice a day, and increasing the dose as far as it can be safely borne, when requisite. In extremely obstinate cases, he has succeeded by applying a solution of nitrate of silver, ten grains to the ounce, to the prostatic portions of the urethra and neck of the bladder. And in the female, this remedy is also easily applicable. Any source of intestinal irritation, as worms, must be removed. Under this course of treatment, the child, who previously had wetted his bed perhaps every night, may at length retain his water; care being taken not to allow the whole night to pass without seeing that the little patient's bladder is relieved voluntarily. With proper management, the child will, after puberty, generally outgrow the complaint.

In *adults*,—Catheterism, to relieve the distended bladder, is always the primary indication of treatment. Other remedial measures must have reference specially to the causes of incontinence.

ENGORGEMENT OF THE BLADDER, AND OVERFLOW OF URINE.—The *regorgement* of the bladder, of French authors, consists in partial retention of urine, and occasional *overflow*, of quite an involuntary character. It depends on the mechanical obstruction of enlarged prostate; this body rising up at the neck of the bladder and forming a corresponding receptacle behind it, in which urine accumulates. When the fluid rises above the level of the enlarged prostate, an overflow takes place, leaving the bladder still engorged. This state of repletion and overflow is proportionate to the size and obstruction offered by the prostate.

The *treatment* by catheterism, as peculiar to enlarged prostate, will be described with that condition.

RETENTION OF URINE.—This *absence* of micturition is considered in connexion with Stricture of the Urethra.

## CHAPTER LIX.

## DISEASES OF THE PROSTATE.

THE Prostate Gland, surrounding the neck of the bladder and commencement of the urethra, is subject to certain Diseases; Inflammation or Prostatitis, acute and chronic; Hypertrophy or simple enlargement, in advanced age; Atrophy; Cancer; Cysts; Tubercle; Calculus.

These diseases, identical in their nature with the same diseases of other parts, require notice only in so far as they present symptoms peculiar to the prostate, and relative to the bladder; which accordingly modify the treatment.

INFLAMMATION OF THE PROSTATE, OR PROSTATITIS.—*Acute* prostatitis rarely occurs unconnected with inflammation of the bladder or of the urethra.

*Symptoms.*—A sensation of weight and fulness about the neck of the bladder, rectum and perineum; frequent and painful micturition, the pain increasing towards the close of the act, and great pain in defæcation; an enlarged, and exquisitely tender state of the prostate is discovered by examination with the finger introduced into the rectum. The accompanying inflammatory fever is often very acute; commencing with rigors, and leading to a high degree of constitutional disturbance.

As the prostate enlarges, micturition becomes difficult, and total retention may ensue from the obstruction. An attempt to pass an ordinary catheter, encounters opposition, and produces great pain, when the instrument reaches the neck of the bladder.

*Causes.*—Prostatitis is usually a consequence of gonorrhœa, the urethral inflammation extending upwards to the prostate; or of injury by the violent use of stricture or lithotripsy-instruments; or it results from the irritation of a calculus, strong injections, or cauterization of the prostatic urethra. Cold and damp to the perineum, will also give rise to it, and especially in gouty or rheumatic subjects. Occasional causes are; alcoholic drinks, and inordinate sexual excitement; when, in either case, urethritis already exists. As an idiopathic inflammation it is very rare.

It terminates in the course of a few days, in resolution, or in suppuration, or becomes *chronic* inflammation.

*Treatment.*—Local blood-letting from the perineum, affords the greatest relief. Ten or twenty leeches should be applied, or cupping performed to the amount of six or eight ounces; followed by warm poppy-head fomentations and hip-baths. A free purgation, and subsequently gentle action of the bowels; with antimonial salines, and low diet; constitute the remainder of the treatment. Retention of urine may yield under a full dose of opium, or necessitate the occasional use of the gum-elastic catheter. By promptly adopting these measures, the inflammation may subside, without suppuration; although there is always a liability to relapse, the prostate remaining enlarged and hardened for some time; and there is some difficulty or delay in the passage of the stream of urine.

*Abscess of Prostate.*—Suppuration is preceded by throbbing about the neck of the bladder or in the perineum; the rectal swelling becomes softer, and fluctuation may be perceptible; pus appears in the urine,



when the abscess bursts into the urethra and discharges through that passage. Generally, the urethral opening soon closes; if it remains open it becomes a receptacle for urine, and induces abscess in the perineum. Sometimes, the abscess opens through the rectum, and may result in the establishment of urethro-rectal fistula. Not unfrequently, the abscess is burst by the introduction of a catheter, in relieving the retention of urine caused by the enlarged gland; the matter being drawn off through the instrument. The quantity discharged may be considerable.

*Peri-prostatic abscess* occurs in not a few cases; the matter forming external to the prostate, and not within the capsule of the organ. Such abscess is of less serious import than prostatic abscess.

*Treatment* should be prompt and decided with the view of giving vent to any formation of matter. When, therefore, there is a tendency to perineal pointing, as indicated by brawny induration, without any fluctuation; an incision should at once be made in the middle line, about three-quarters of an inch anterior to the anus, and down to the matter; taking care to avoid the rectum. With this view, the fore-finger of the left hand should be introduced into the bowel; a long, straight, and narrow, sharp-pointed bistoury used, and the edge be directed upwards. The depth to which the incision must be carried will be an inch and a half to two inches, and it is extended straight upwards in the raphé just sufficiently to give a fair patulous aperture. Relief is immediate. If no pus makes its appearance, the relief of tension and pain will be effected, and the matter may escape through the wound after poulticing for a few hours. Thus then, communication with the urethra or rectum is prevented. Puncture through the rectum has been made occasionally, when fluctuation was distinctly felt in that situation.

Peri-prostatic abscess must be treated in like manner, there being no practical distinction between it and prostatic abscess.

*Chronic inflammation* results in enlargement of the prostate; with frequent micturition, but a less forcible propulsion of urine, followed perhaps by a drop or two of blood; usually also there is a gleet discharge, and the urine is milky and deposits more or less pus on standing. Pain in sexual intercourse, and nocturnal emissions are often experienced. These symptoms are much increased by riding on horseback or prolonged walking exercise, and by errors of diet. Examination with the finger per rectum will discover the prostatic enlargement.

*Treatment* consists in counter-irritation to the perineum, and careful regulation of the digestive organs; the administration of iodide of potassium, tonics, especially iron and quinine, and a supporting diet. Nocturnal emissions are best overcome by the application of nitrate of silver to the prostatic urethra. By pursuing this course of treatment for a long period, a cure will generally be effected.

**CHRONIC ENLARGEMENT, OR HYPERTROPHY, OF THE PROSTATE.**—This prostatic affection is of common occurrence after the age of fifty-five to sixty years; but it never happens before the first named period, and extreme old age seems to be less liable to it. Age and this prostatic enlargement are, therefore, invariably associated. Chronic inflammatory enlargement of the prostate may occur at any age after puberty; but the chronic enlargement of the gland in advanced life is quite distinct from any inflammatory state, it is an hypertrophied condition.

*Structural condition.*—The dissections by Sir H. Thompson and by Dr. Messer, have thrown much light on the structural alterations which

constitute chronic enlargement of the prostate. The tissues of which the prostate gland consists—in its normal or anatomical structure—are; first, unstriped muscular fibre, with connective tissue; forming at least three-fourths of the prostatic body; secondly, interspersed among this structure are numerous branching glandular tubes and cysts with their accompanying ducts. Enlargement or hypertrophy may be determined by an abnormal production of the first-named elements alone; or with some of the glandular tissue interspersed, and which may be imperfectly or fully developed. The *parts* of the prostate thus affected; may be the two lateral lobes, which are sometimes increased to four or six times their natural weight and bulk; or an outgrowth may take place from the central part of the organ, in a backward direction towards the cavity of the bladder, as a more or less rounded or pyriform tumour of prostatic tissue,—the enlarged “middle or third lobe;” and this form is one most commonly met with. Generally, the whole organ more or less partakes in the enlargement. *Isolated* tumours of prostatic tissue are also very commonly produced, and found imbedded within the proper structure of the prostate. Consisting principally of the unstriped muscular tissue, they form small rounded bodies, sometimes completely isolated by a limiting fibrous cyst. These small imbedded tumours seem to have a relation to the containing organ, similar to fibrous tumours in the uterus.

*Signs.*—The *physical* characters of the enlarged prostate are not so definite as the structural condition. In consistence, it is usually firmer and harder than natural, as if the organ were enclosed within a tight or stretched envelope; sometimes, it feels looser and softer than natural. The formation of numerous fibrous tumours within the prostatic substance, will more especially present the former character. In external colour there is no change from the healthy state, unlike malignant enlargement. The weight and size of a simply enlarged prostate are sometimes very remarkable. Taking the average weight of a healthy prostate to be  $4\frac{3}{4}$  drachms; the average size is,—from base to apex  $1\frac{1}{4}$  to  $1\frac{1}{2}$  inch, transversely  $1\frac{3}{4}$  inch, exceeding the antero-posterior diameter by a fourth or fifth; and the greatest thickness,  $\frac{5}{8}$  to  $\frac{7}{8}$  inch. (H. Thompson.) Weight is a fair index to size. The enlarged prostate reaches commonly to 8 or 12 drachms, or more than double the natural size. A prostate weighing an ounce, will have attained to the size of one inch in thickness from before backwards, and two inches in a transverse direction. Three inches transversely is not uncommon, and even four inches or rather more has been attained. The weight has been known to reach to twelve ounces.

*Structural alterations in the Prostatic Urethra, and Neck of the Bladder.*—The consequence of prostatic enlargement is obstruction to the passage of urine; and this produces certain structural changes in the vesico-urethral portion of the canal. The *prostatic urethra* undergoes enlargement in its antero-posterior diameter, with diminution of its transverse or lateral diameter, the canal becoming a narrow passage; instead of being, when distended, of nearly equal diameter in both directions. In point of length this portion of the urethra is also much increased; measuring perhaps four inches from the orifice of the bladder to the membranous portion; instead of its normal length, one inch and a half. Its direction deviates also; with enlargement of the middle lobe, the urethra rises abruptly as an angular curvature instead of a nearly straight line; thus presenting a complete step or “bar at the neck of the

bladder," over which an instrument must be made to pass before it will enter the cavity. An outgrowth from the middle lobe occasionally forms as a valve, overlapping the vesical orifice; and which being forced forwards in the act of micturition, more completely obstructs the passage of urine. With enlargement of either lateral lobe, in addition to that of the middle portion, the lateral direction of the prostatic urethra is also changed; curving to the left, when the right lobe is enlarged, and *vice versâ*. The *vesico-urethral orifice* or opening of the bladder, undergoes alterations of shape; becoming crescentic, with the convexity turned upwards, when the middle lobe is enlarged; or turned to the left or right, according as the enlargement of the lobe on the *opposite* side predominates.

Thus then, the urethral canal, as a whole, is always *elongated* and *more curved*; while the prostatic portion and vesical orifice may sometimes together have a *tortuous* course. These alterations, however, are necessarily alike dependent on the prostatic portion of the urethra; or as regards the vesical orifice, on the prostate just within the bladder.

The *causes* of chronic prostatic enlargement or hypertrophy, are obscure. Various causes have been assigned, all of which are disproved by the searching examination to which Sir H. Thompson has submitted this question. All circumstances which tend to induce active determination of blood to the part, may aid in the development of hypertrophy. Hence, emotional excitement of a sexual kind, actual excesses, overstimulating food, sedentary habits, horse-exercise, and such like, may be enumerated as accessory causes of this affection. But the *initial* cause or origin seems to be unknown.

*Symptoms.*—Commencing insidiously, chronic enlargement of the prostate makes some perhaps considerable progress before any marked symptom supervenes. Then, the symptoms manifested are:—increased frequency of micturition with more or less urgency of desire; a bearing-down sense of weight about the neck of the bladder and rectum, with perhaps pain in the glans penis and testicles; a less forcible propulsion of urine with delay rather than difficulty in its passage, but each act of micturition is felt to be incomplete and is concluded by an involuntary leaky dribbling; there may be slight hæmorrhage occasionally, and some muco-purulent discharge from the urethra. In addition to these four groups of symptoms, which severally may arise from other causes than enlargement of the prostate; there is the physical sign of an enlarged, and more or less hardened, state of this body, as discovered by introducing the fore-finger into the rectum, and feeling in the situation of the prostate at the neck of the bladder.

Taking these symptoms in order, each may be observed more particularly. Increased frequency of micturition occurs mostly after the bladder has become distended during sleep, on rising in the morning, when the desire for relief returns in a few minutes. Uneasiness about the neck of the bladder may induce such expulsive efforts as to strain away some of the contents of the bowel during the act of micturition, at length leading to prolapsus and hæmorrhoids. Flattened motions and frequent erections of the penis, are also not unfrequently concomitant symptoms. Increased frequency of micturition alone might seem to denote that the bladder cannot retain urine, owing simply to irritability of the organ; but the diminished force with which the stream is propelled, with the delay before it is established, and the sense of incomplete relief after apparently



completing the act, are very significant of the state of the bladder. It cannot evacuate the urine, and remains, partially at least, distended.

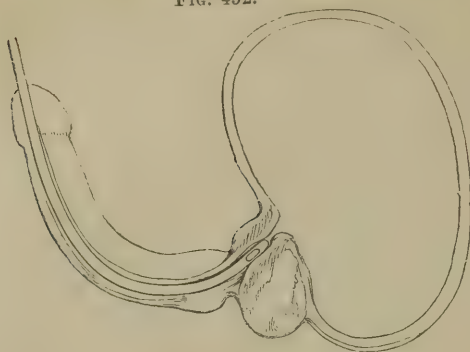
Pathology supplies the true explanation of all these symptoms. The enlarged prostate projects upwards into the bladder, and urine accumulates in the receptacle thus formed behind the prostate. The bladder is never emptied below the level of the prostatic projection. Consequently, frequent, straining, efforts are made; but the stream issues with less propulsive force, slowly, and ineffectually; the surplus urine only or overflow passing off, the residual urine, often in large quantity, still remains below the prostate in the bladder. Even this occasional discharge can occur only when the bladder is sufficiently distended to obey its own contraction, and the straining compression of the abdominal muscles, to overcome the resistance offered by the enlarged prostate. An involuntary dribbling of urine takes place occasionally, from over-distension; the incontinence of adults. Attacks of complete retention may supervene from any cause of temporary prostate congestion; as by exposure to cold or damp, sexual excitement, or some error in diet; and such an attack is sometimes the first occasion of discovering the existence of prostatic enlargement. Complete retention, and a distended state of the bladder, is indicated by dullness on percussion above the pubes, extending possibly as high as the umbilicus. The slight hæmorrhage, and perhaps mucopurulent urethral discharge, not unfrequently happen under similar circumstances of prostatic congestion. Profuse hæmorrhage has been known to occur from transfixing a projecting portion of the prostate, in incautiously or forcibly passing a catheter.

The enlarged prostate as *felt* on introducing the finger into the rectum, varies in size and consistence. Usually it is that of a large chestnut, or a small compressed orange, and of largest extent transversely, —stretching perhaps across the upper surface of the bowel from side to side at the neck of the bladder; or either lateral lobe may be enlarged singly, the right or the left. The consistence is usually firm and resisting, sometimes soft or unequally hard at different parts of the surface. It may be impossible to ascertain the extent of the enlargement backwards, which is often beyond reach of the finger. By tilting upwards and forwards the base of the bladder, some of the residual urine may be expelled; or by passing a catheter through the urethra, several ounces of urine, ten, twenty, thirty, forty, or more, may be drawn off, although the act of micturition had just previously been performed. The patient who had imagined his inability to retain, is now convinced of his inability to expel his urine,—that his bladder retains too much.

*Urethral exploration* with a catheter will afford information which rectal exploration cannot convey, respecting the state of the middle lobe, and as to the elongation and curve of the urethra in its prostatic portion; thus completing the examination. For this purpose it is better to use first, a full-sized catheter of the ordinary length and curve, as the standard of comparison; so that any alterations from the healthy condition may be at once made apparent. If, with no perceptible enlargement by rectal exploration, the urine flows when the instrument has traversed not more than the ordinary distance,—about six to eight inches; while the handle has not been more than usually depressed; there will assuredly be no prostatic enlargement. But, if the catheter has passed easily nine or ten inches and still no urine flows; while following its course, the handle has become more than usually depressed; there will assuredly be prostatic

enlargement. Then the *prostatic catheter* should be used; a longer instrument by from two to four inches, and having a much larger curve.

FIG. 452.



(Fig. 452.) The increased length and the direction of the prostatic canal can be estimated by means of this instrument; the one fact, by observing the length of shaft introduced; the other, by its position when the point enters the bladder. Any deflection of the instrument, to the right or to the left, when allowed to take its own inclination, will further indicate a greater degree of enlarge-

ment on the side *towards* which the handle inclines.

Examination of the prostate, thus far, may be conducted advantageously, by using the finger in the rectum and the catheter in the bladder, at the same time; the concerted movements of the two instruments indicating, moreover, the thickness of the prostate, as well as the length and course of the prostatic urethra.

Exploration of the urethro-vesical orifice and of the vesical portion of the prostate, with the fossa or receptacle behind it; can be severally effected by means of a *sound* having a very short curve or only a beak. On passing this instrument into the bladder the beak is then turned down, and the post-prostatic receptacle sounded as to its depth, and searched for stone,—a not uncommon concomitant of enlarged prostate; in withdrawing the beak forwards, the posterior limit of the prostatic enlargement is ascertained,—a point not often ascertainable by rectal exploration; then the state of the middle lobe is determined, more clearly than by the upward curve in entering the bladder; finally, the condition of the vesical orifice, by turning the beak round to the right and to the left.

*Diagnosis.*—Enlargement of the prostate must be distinguished from; (1) stricture of the urethra, (2) stone in the bladder; (3) tumour of the bladder; (4) simple atony of the bladder; (5) paralysis.

In *Stricture*, the diminished force of the stream of urine is the same, or even less; but the volume is also diminished, even to that of the smallest stream short of retention; and, moreover, it becomes variously broken, twisted, or dribbling. Catheterism affords, however, the chief points of distinction; obstruction is encountered always before the instrument reaches the prostatic urethra, and generally before six inches of the instrument have disappeared. In enlarged prostate, seven, eight or nine inches of the instrument will have disappeared without encountering obstruction; and not necessarily then, if the instrument be of sufficient length to enter the bladder. But the handle must be depressed between the patient's legs to a much greater degree than in passing stricture. The difference of age in the two cases will corroborate the diagnosis; stricture almost invariably appearing before middle life; prostatic enlargement not until after that period.

*Stone* in the bladder may be distinguished from enlargement of the pro-

state by certain features pertaining to each of the symptoms. Pain in the glans penis and vesical irritability are most marked *after* micturition, when the bladder is empty and the stone settles down on the more sensitive base of the bladder behind the prostate; and these symptoms are also then aggravated by exercise or any movement whereby the stone rolls about on that part. The stream of urine often stops suddenly, by the stone falling over the vesical orifice; but this symptom is liable to happen also when an outgrowth from the middle lobe of the prostate exists in the form of a valve,—which from time to time overlaps the neck of the bladder, a rare form of prostatic enlargement. Vesical hæmorrhage is of more common occurrence as a symptom of calculus; the blood passed, florid and unmixed, is more abundant in quantity, and it is especially liable to occur *after* exercise by attrition of the stone on the mucous membrane of the bladder. Sounding affords conclusive evidence of stone, when the foreign body can be distinctly struck.

The *co-existence* of stone with an enlarged prostate,—a not unfrequent combination, renders the diagnosis far more ambiguous. If the calculus lies in the receptacle behind the enlarged prostate, the pain in the penis and vesical irritability will be less marked or *absent*; owing to the removal of the foreign body from the sensitive neck of the bladder. Any indication by the sudden cessation of the stream of urine, being equivocal evidence; it is then that occasional hæmorrhage, and especially careful sounding, as already described, afford the most reliable ground of diagnosis as to the existence of stone. Rectal exploration will more completely discover the prostatic enlargement.

From *non-prostatic tumour*, chronic enlargement of the prostate may be known principally by careful urethral exploration, with the beaked sound; and by examination of any urethral discharge with the microscope, which reveals perhaps the presence of characteristic structural elements.

From simple *atony* of the bladder, the diagnosis of enlarged prostate turns upon the twofold fact; that when a catheter is introduced into the bladder, no urine or scarcely any flows;—in the recumbent position, nor is it much propelled by any efforts of the patient. Atony may, however, have supervened from over-distension, as a consequence of prostatic enlargement. In *paralysis* of the bladder, when a catheter is introduced, urine flows, and in a stream as full and forcible as after removal of the obstruction of an enlarged prostate; but there is inability on the part of the patient to propel the urine by any voluntary action of the abdominal muscles,—this inability being of course proportionate to the completeness of the paralysis. The lower extremities also are almost always involved, and this paralytic condition results from injury or disease of the nervous centres,—brain or spinal cord.

*Consequences, and Terminations.*—*Chronic* cystitis, or a state of the bladder bordering on it, commonly ensues from the habitual retention of urine and distension of the bladder. Hence, the characters of the *urine* in chronic enlargement of the prostate, are such as depend on decomposition of some of its constituents, from retention, mixed with the products of chronic inflammation of the vesical mucous membrane. The interior of the bladder changes in colour to a grayish-slate hue, as seen after death; and viscid mucus or purulent matter, streaked with whitish phosphatic deposit, and occasionally tinged with blood, is voided in the urine; which is now alkaline, and of a pungent ammoniacal or fœtid odour. The quantity



of urine passed varies much from day to day; the measure being generally much above, although sometimes below, the average healthy standard. The patient's general health declines during the course of his habitual retention, and inflammatory affection of the bladder. As the result of broken rest, from ineffectually relieving the bladder, and constitutional disturbance owing to the state of the organ; he becomes sallow and dejected, he loses flesh and strength, and "ages" fast. Occasional attacks of complete retention throw him further back. A *gradual decline* of health takes place; or *rapid depression* may occur; from ulceration or sloughing of the bladder, with repeated hæmorrhage, or from profuse purulent discharge. *Uræmia*, from suppression of urine sometimes closes the scene.

*Post-mortem Examination.*—Certain *pathological conditions* of the bladder, ureters and kidneys, result from the mechanical and backward effect of long-continued retention of urine. They are discovered *after* death. The *bladder* is thickened, principally in its muscular coat, and its hypertrophied muscular bands project inwards in the form of prominent fasciculi; between which the mucous membrane protrudes externally and has become sacculated, under the constant pressure of the retained urine. At the base of the bladder, a pouch or receptacle has formed behind the enlarged prostate, capable of holding perhaps several ounces of the ammoniacal, fætid, urine; and in which mucous and phosphatic concretion-matter, are also apt to accumulate. The backward pressure of urine distends, and eventually dilates the *ureters*; and the secreting substance of the *kidneys*,—in their pyramidal and cortical portions, are atrophied; resulting perhaps in sacculated remnant kidneys. Hence, necessarily, suppression of urine, and uræmic blood-poisoning.

*Treatment.*—Palliative measures alone have any effect in chronic enlargement of the prostate; and they relate to the relief of retention by catheterism or other operative interference; and the prevention or relief of chronic cystitis, and the maintenance of the general health.

*Retention of Urine.*—Having regard to the constant retention of a certain quantity of residual urine in the bladder; the organ should be emptied mechanically, at least once a day, or twice or three times; according to the amount of obstruction and the consequent accumulation of residual urine. The *prostatic catheter*, is larger-sized, longer, and more curved than an ordinary catheter; and thus being adapted to the corresponding alterations in the urethra, the urine can be more conveniently drawn off by this instrument. Two points should be observed in passing the instrument into the bladder; not to mistake the dilatation of the prostatic urethra for the bladder, an ounce of urine perhaps thence escaping as if the instrument had entered its cavity; and in the next place, to depress the handle of the instrument sufficiently to curve upwards into the bladder and avoid hitching against any enlargement of the middle lobe. Care should be taken to empty the receptacle behind the prostate, by turning and depressing the point of the instrument. The patient should be taught to pass it in his own person; that he may relieve himself as occasion requires. As a rule, it will be unnecessary and undesirable to allow the catheter to remain in the bladder; but if it be requisite to procure ease and sleep, this continued use of the instrument will be highly beneficial. It may be left in the bladder during the night, for example. A gum-elastic catheter is then preferable as being less liable to irritate the mucous membrane. By thus habitually relieving habitual retention,

the patient's existence is rendered more tolerable or even comfortable, and life may be considerably prolonged.

When no instrument can be introduced into the bladder, other methods of gaining an entry may be resorted to. They are; forcible catheterism or tunnelling the prostate; puncture of the bladder through the rectum; or puncture above the pubes.

Of these three methods; *forcible catheterism* is recommended by Brodie, Liston, and other Surgeons of large experience; as a safer procedure than puncture through the rectum. The instrument having been thrust through the obstructing portion of the prostate, is left in the bladder for about forty-eight hours, to establish a false passage for its re-introduction.

Puncture through the rectum, and above the pubes, will severally be more appropriately considered and described in stricture of the urethra.

The tendency to *chronic cystitis* as dependent on prostatic enlargement, may be averted; partly by preventing retention, partly by careful regulation of the diet, and the avoidance of exposure to cold or damp, or other causes of any disordered state of the urine, or of determination of blood to the bladder. Remedial treatment is considered in connexion with this vesical affection.

The maintenance of the general health must be conducted on ordinary principles, chiefly of a hygienic character.

**ATROPHY OF THE PROSTATE.**—This prostatic condition is sometimes found in old age, and occasionally in early adult life. The prostate gland is but slightly developed in men whose sexual character is not strongly marked, and in some malformations. No special symptoms or treatment are known.

**CANCER OF THE PROSTATE.**—Cancer occurs less commonly as a secondary deposit, than as a primary disease of the prostate. The form of cancer is almost always encephaloid, and sometimes it is associated with melanotic deposit; scirrhus seems to be of doubtful occurrence.

Age has apparently a certain relation to malignant prostatic disease; it has been observed only in childhood and advancing age. No authenticated cases, observes Sir H. Thompson, are on record between the ages of eight and forty-one.

The *symptoms* are those of prostatic enlargement; but distinguished by the severity of the pain, and its shooting into the rectum, up to the sacrum, and down the thighs; the oft-recurring and more abundant hæmorrhage; and perhaps, constitutional cachexia. The tumour examined through the rectum, as compared with chronic prostatic enlargement, is of larger size, harder and perhaps of irregular shape; subsequently becoming softer and fungating. The adjacent lymphatic glands are affected, both lumbar and inguinal; corroborating the diagnosis. The urine has been said to exhibit under the microscope, characteristic cancer cells; but the resemblance of the epithelial cells, renders this evidence doubtful. Marked rapidity of the symptoms, however, characterizes the malignant disease; its duration from first to last extending only from one and a half to five years in adults, and from three to nine months only in children.

The *treatment* is palliative. Catheterism should be avoided if possible, and then performed with the gentlest touch, not to irritate or injure the part. Anodynes in the form of opium or conium may be administered both by mouth and rectum. Hæmorrhage must be treated as explained in connexion with hæmaturia. The general health and strength will require all the support which can be given by tonics, and a nutritious diet.

**Cysts.**—The substance of the prostate is often beset with numerous small cavities, of an irregular shape, and communicating with the ducts of the glandular structure. They are apparently dilated prostatic follicles. Some such cysts contain several minute concretions or prostatic calculi of larger size, and each occupying a separate recess.

No special symptoms are presented by these small cystiform cavities, and the diagnosis is unimportant, as it would not afford any indication for special treatment.

A cystic condition of the prostate is sometimes met with, resulting from long-continued suppuration with absorption of the glandular substance; and thus forming one large cavity containing pus. The capsule of the prostate has become the pus-secreting sac of an *abscess*.

An *hydatid cyst* has occasionally formed between the bladder, near its neck, and the rectum. This condition is attended with retention of urine and distension of the bladder; simulating the symptoms of prostatic enlargement. The formation of any such cyst within the substance of the prostate seems doubtful.

**TUBERCLE.**—The prostate is very rarely the seat of tubercular deposit, and then always as a secondary affection; some other part of the genito-urinary tract being the primary seat of deposit. The kidney ranks first, and next the testicle. Phthisis pulmonalis is generally associated with the tubercular affection of a genito-urinary organ. Frequent and painful micturition, with some obstruction to the passage of urine, and occasionally slight hæmorrhage, constitute the symptoms. There is also some amount of prostatic enlargement, ascertainable by rectal examination. Subsequently, with suppuration and discharge, the prostate becomes smaller than natural, and the urine purulent. But the absence of special symptoms, and the co-existence of at least a phthisical tendency, will determine the diagnosis.

*Treatment* must be conducted on general principles.

**PROSTATIC CALCULUS.**—The prostate gland, like other glands, is liable to an inspissation of its secretion, forming nuclei around which inorganic deposit and concretion takes place, within the ducts of the follicular structure. This mode of origin, and situation, are characteristic of true prostatic calculus, and distinguish it from urinary calculus which may have lodged in the prostate. Prostatic calculus is composed principally of phosphate of lime, about 84 per cent., with a trace of carbonate of lime; organic matter, 15 per cent., constituting the remainder.

The physical characters of these calculi are peculiar:—their colour is generally a brown chestnut, sometimes black, red, or white; occasionally transparent or like pearl-barley; of softish, or hard consistence; their form is commonly very irregular, faceted, triangular or square; and their size varies from that of granular sand to a poppy-seed or cherry-stone. In point of number, 1, 2, 3, or more, even to 100, may exist, like a bag of marbles. By constant attrition, the facets become smooth and polished. Continued deposition of phosphatic matter at length produces a larger calculus; encroaching on the rectum, or coming forward out of the mouths of the distended prostatic pouches into the prostatic urethra; thence extending forwards, or backwards into the bladder, it forms a prostatovesical calculus. Sometimes one or more prostatic calculi become detached, free and moveable in an open duct. These enlarged calculi have a very irregular or branched appearance.

*Symptoms.*—The symptoms of calculi in the prostate depend on their



situation, size, and number. When small, the symptoms may be absent, or slight. When of larger size, they give rise to pain and weight in the perineum with uneasiness at the neck of the bladder; frequent micturition, sometimes retention of urine, and difficulty in the emission of semen; mucous deposit in the urine, and occasionally erections of the penis. Such are the symptoms of enlarged and irritated prostate; but there is also the physical character of one or more stones in the prostate; as discovered by urethral or rectal exploration, or both. On passing a sound through the urethra, a distinct grating or click is felt and heard, just before the beak of the instrument enters the bladder; a deeply imbedded calculus may be felt by introducing the finger into the rectum; or by simultaneous examination, the calculus may be felt between the finger and sound. A large number of small calculi communicate to the finger a crackling or grating sensation, like that of small marbles in a bag.

Suppuration of the prostate sometimes ensues, forming abscesses.

*Treatment.*—When the calculi are small and free, they admit of extraction by a properly constructed forceps, such as Weiss's long urethral forceps or Weiss's canula forceps. But if the calculi are numerous and not to be felt through the urethra, this procedure will be impracticable; and palliative treatment only can be employed to subdue irritation and relieve retention by occasionally using the catheter.

When the calculi are large, single, or at most only two or three in number; median lithotomy should be performed, and the calculus removed with scoop or forceps. A larger-sized calculus may necessitate the lateral operation.

If there be no urgent symptoms, the case may be wisely left alone.

Urinary calculus or fragment, which has lodged in the prostate, should be extracted by urethral forceps; or, that procedure failing, it may be pushed back into the bladder and then dealt with.

Prostatic and vesical calculus co-existing, both can be removed by the lateral operation.

## CHAPTER LX.

### DISEASES OF THE URETHRA.

THE urethral canal is liable to; (1) Inflammation or Urethritis, and its more specific form, Gonorrhœa; (2) Stricture or contraction of the canal, in some part or parts of its extent; as a structural or organic and permanent condition, or as a spasmodic, or an inflammatory state; (3) Tumours occasionally; (4) Urethral Calculus.

The results of Urethral obstruction comprise;—Retention of Urine; Extravasation; Rupture of the Bladder; and Urinary Fistulæ;—penile, scrotal, perineal, urethro-vaginal, and the associated vesico-vaginal fistula.

*URETHRITIS.*—*Simple* inflammation of the urethral mucous membrane is of not uncommon occurrence, and in either sex.

*Symptoms.*—Heat, pricking, and tension in the urethra for a day or two, are accompanied by some scalding sensation in passing water,—ardor urinæ; and soon followed by muco-purulent urethral discharge. The only symptom may be this whitish discharge; unaccompanied with ardor urinæ, and inflammation.

In the former or *active* condition, the diagnosis from gonorrhœa, is extremely difficult; in the latter or *passive* condition, the distinction is more obvious; resembling gleet, it differs in the thicker and more opaque character of the discharge. The causes of simple urethritis differ also from that of gonorrhœa, which arises from a specific contagion; though here it must be confessed, the line of distinction is even less definite.

*Causes.*—Certain constitutional causes; gout, rheumatism, scrofula, and the use of particular medicines, as guaiacum or Cayenne pepper; frequently induce urethritis. These causes seem to affect the urethra by morbid states of the urine, as when it is loaded with lithic or with oxalic acid; thus producing *direct* irritation in the passage of such urine. They give rise to the active form of urethritis, and the discharge disappears immediately upon the development of the constitutional disease. *Distant* irritation, as gastric derangement, worms in the intestines, or teething, may also excite an urethral discharge; but this is of the passive character.

Local causes of various kinds are not unfrequently the occasions of urethral irritation; as the passage of instruments, sexual intercourse, or the introduction of vaginal discharges,—such as the menstrual fluid, leucorrhœal matter, &c. Here again, the discharge is generally passive.

It, therefore, becomes most important from a medico-legal point of view, to attribute an urethral discharge to its right cause. In young children, the existence of vaginal discharge is not absolute evidence that a rape has been committed. And in persons who are subjects of stricture and irritable urethra, a discharge apparently gonorrhœal sometimes exists, or appears after sexual intercourse, or even after sexual excitement, a debauch, or other stimulant affecting the urethra.

The duration of the symptoms is not nearly so long as in gonorrhœa; simple urethritis usually subsiding at the end of a week or ten days. Chronic discharge not unfrequently becomes established in gouty persons, or in conjunction with stricture.

*Treatment* consists in removing the cause of irritation, and in mild antiphlogistic measures. Thus, saline aperients of bicarbonate of potash and sulphate of magnesia, combined perhaps with colchicum, will often succeed in subduing the inflammatory symptoms. At the same time, a moderate and non-stimulating diet must be observed. Then, when the discharge has become passive, weak astringent injections, as of the liquor plumbi diacetatis, alumi, or sulphate of zinc, will gradually arrest the urethral secretion and complete the cure. I never use the two latter forms of astringents. Copaiba, cubebs, or both mixed, are also administered in this state of the discharge; but I do not find it necessary to have recourse to these agents.

When urethritis is conjoined with stricture, temporary retention of urine may ensue, partly of a spasmodic character. In addition to antiphlogistic treatment; opiates, opiate suppositories, and the relaxing influence of warm hip-baths occasionally, will generally overcome the obstruction. Catheterism should be avoided until relief cannot be obtained without it.

*Gonorrhœa or Blennorrhagia.*—This form of Urethritis is accompanied with a muco-purulent discharge; and is generally produced by contagion or contact with a *similar* discharge, usually during sexual intercourse. It may affect either the male or female.

In the *male*, the urethra is the seat of gonorrhœa, and especially the anterior portion as far as the fossa navicularis within the glans penis; but the urethral inflammation may extend backwards along the whole length

of the canal, particularly affecting the bulbous portion; and even involve the whole mucous membrane of the bladder, in extreme cases. When the inflammation has become chronic, the bulbous portion of the urethra is more especially affected, the intermediate anterior portion up to the fossa is comparatively unaffected. Other portions of the genital mucous membrane may be *secondarily* involved, as that of the prepuce and glans.

*Symptoms.*—Commencing usually from the second to the fifth day after exposure to contagion, or sometimes, though rarely, at later dates; the progress of the disease may be divided into four tolerably definite stages:—(1) The period of irritation; (2) that of Inflammation, acute; (3) chronic or declining; (4) gleet, a chronic state of peculiar discharge which does not always supervene.

*Urethral irritation.*—This stage is characterized by very slight symptoms; an itching or tickling sensation in the meatus, its lips are florid red, puffed, and glued together by a scanty, viscid, clear and colourless or slightly opalescent secretion. Some smarting is experienced in passing urine, but no scalding,—no ardor urinæ. The duration of this stage varies from a few hours to two or three days.

*Acute inflammation.*—The discharge has become an abundant, thick, opaque and greenish-yellow pus; and scalding pain is felt in passing urine, which is voided with difficulty in a diminished or forked stream, or in spasmodic jerks, and with increased frequency. The whole glans is swollen and of a bright cherry-red colour, the course of the urethra is swollen and cord-like to the touch, the prepuce may become œdematous, and the whole penis looks and feels turgescient. When the bulbous portion of the urethra is affected, weight in the perineum will be experienced; and if the prostatic urethra be involved, there will be weight about the anus.

*Chordee* not unfrequently occurs, a painful arching or twisting of the penis downwards during erection; to which there is an involuntary tendency, especially when the patient becomes warm in bed. Thus sleep becomes much disturbed. This bent position of the penis in erection, seems to be the result of the in-extensibility of the corpus spongiosum, owing to the lymph effusion around the urethral canal. When, therefore, erection occurs, this corpus spongiosum not yielding to the distension of the corpora cavernosa, it acts like the string of a bow and bends the penis downwards. Another explanation of chordee is, that it arises from spasm of the muscular fibres which surround the whole course of the urethra.

The characteristic discharge and scalding in micturition, constitute what is vulgarly called the “clap” in England, and “chaude-pisse” in France. Inflammatory feverishness sometimes accompanies this acute inflammatory stage of gonorrhœa, especially in conjunction with chordee; often, however, there is little constitutional disturbance. This stage lasts from one to three weeks; its continuance depending on the number of previous attacks and the habits of the individual.

*Chronic Stage.*—The inflammation having risen rapidly to its highest degree of intensity, now gradually declines;—the discharge of pus slowly subsides again into muco-pus, less abundant and thinner; and the scalding reverts into smarting, or soreness only in micturition. This stage terminates under treatment, in about another three weeks; but it is liable to be prolonged by recurring inflammation under adverse circumstances. Gonorrhœa rarely terminates spontaneously, in less than three months; though change of air, to the sea-side in particular, will often finish off a



slight urethral moisture at an earlier period. The general health undergoes a marked depression during the continuance of gonorrhœa; the patient acquiring a remarkably pallid, listless appearance.

*Gleet.*—Blennorrhœa or gleet must be regarded as the sequel, rather than the concluding stage of gonorrhœa; for it does not invariably occur. It signifies an urethral discharge, scanty, thin, nearly clear and colourless, of muco-purulent character; but unaccompanied with scalding in micturition or other inflammatory symptoms, and persistent,—lasting for months or even years. Thus we speak of an old-standing gleety urethral discharge. It may be maintained by certain constitutional conditions; a scrofulous, rheumatic, or gouty diathesis; a lymphatic, weakly, temperament; or a state of debility. The *contagious* character of a gleety urethral discharge is always more or less persistent; and it is even liable to be developed into a more virulent puriform secretion by slight exciting causes. Sexual intercourse, therefore, is unsafe, so long as *any* discharge exists.

The *diagnosis* of gonorrhœa from simple urethritis has already been noticed. No positive distinction can be drawn from the appearance of the discharge, its contagious nature, or from its having been produced by contagion. As Ricord truly observes, "Gonorrhœa often arises from intercourse with women who themselves have not the disease;" and Diday affirms yet more explicitly; "that from the very fact of a woman having a discharge, no matter what its origin, she is liable to give a discharge to a man."

*Causes.*—Gonorrhœal virus or matter, and occasionally any other discharge, as menstrual fluid or leucorrhœal matter; may severally communicate or give rise to gonorrhœa. Either matter may be the source of contagion, and produce true gonorrhœa in a man. The causative distinction between gonorrhœa and simple urethritis, as formerly held in virtue of the *specific* character of gonorrhœal pus, is now generally acknowledged to be no longer tenable. The contagious character of gonorrhœal pus is more virulent, and the symptoms produced are generally more severe; but the only real ground of distinction is that simple urethritis arises from other causes,—constitutional and local, as well as from any contagious discharge.

The following additional practical facts, although not perhaps exclusively characteristic of gonorrhœal contagion, appear to be well established; 1. The disease is not communicable by sexual intercourse *before* the discharge appears. 2. After the discharge is established, if the urethra be previously washed out by means of a syringe, the disease will probably not be communicated. 3. The matter retains the power of infection for an indefinite period; in one case Titley records that a girl communicated the disease immediately on leaving the Magdalen Hospital, after a seclusion of one year; and in another case, according to Hunter, after two years' seclusion. 4. With gleet, two persons being thus affected, may have intercourse with impunity, but either of them will communicate gonorrhœa to a sound person. 5. The violence of the symptoms depends on constitutional conditions, as the gouty diathesis, and habits of life, as intemperance; thus the same woman may give a very mild gonorrhœa to one man, and a most severe one to another. 6. The first attack of the disease is generally the most severe; a kind of urethral tolerance of the disease being commonly found to follow repeated attacks. 7. The severity and the continuance of gonorrhœa are often inverse; it is most severe in

young and plethoric persons, in the gouty or rheumatic diathesis, and in first attacks; but most obstinate in serofulous and phlegmatic constitutions, in persons affected with chronic skin diseases, and after repeated attacks. 8. The disease seems to be much milder now than formerly.

The generation of gonorrhœa *de novo* is an open question; many apparent causes of origin are rendered very doubtful by the persistently contagious character of even a slight gleet discharge.

Gonorrhœal virus differs entirely from syphilitic virus, as shown by the test of inoculation; neither disease being capable of reproducing the other under any circumstances. They are not convertible diseases.

COMPLICATIONS.—Several morbid conditions of the urethra or of adjoining parts may occur in conjunction with gonorrhœa, as complications of this disease.

1. *Chordee*, a bent and painful erection of the penis, has been already noticed.

2. *Irritation or actual inflammation of the urinary organs*, is apt to occur; sometimes of the deeper portion of the urethra, producing great pain in the perineum, with spasm of the accelerator and other muscles during micturition; thus interrupting the stream of urine, or amounting to complete retention; sometimes of the bladder, causing frequent and painful micturition, the pain continuing for some time afterwards, together with a mucous deposit in the urine; or there may be symptoms of renal irritation, marked by pain in the loins, shivering, vomiting, and albuminous, bloody or purulent urine. This state, with or without symptoms of cystitis, is likely to be induced by early or strong injections, want of rest, indulgence in spirituous liquors, or the use of copaiba in large doses.

3. *Hæmorrhage* from the urethra, from rupture of some of the distended vessels during violent erections, or in *chordee*. The loss of blood is rarely considerable, and generally gives relief.

4. Inflammation and suppuration of some of the *mucous follicles* of the urethra, leading to obstruction; until the abscess bursts into the urethra, or externally, or in both directions.

5. Inflammation of the *inguinal lymphatic glands*, constituting *sympathetic bubo*. This complication occurs generally during the second or inflammatory stage of gonorrhœa. Such buboes rarely proceed to suppuration, unless when subjected to irritation, or in persons of a strumous and debilitated constitution. The lymphatics along the dorsum of the penis may also be affected.

6. *Balanitis or gonorrhœa externa*, is an inflammation of the mucous membrane of the glans and prepuce, attended with profuse, thin opalescent discharge, and excoriation. It occurs mostly in persons who have a long prepuce. And it may be induced by want of cleanliness, hot weather, or by disordered health.

7. *Phymosis* and *Paraphymosis* are terms applied to two exactly opposite conditions of the prepuce, relative to the glans penis. In the first, the prepuce cannot be retracted, or not easily, behind the glans, so as to uncover it; in the second, the prepuce cannot be drawn forward from behind the glans, so as to cover that part of the penis. Both preputial conditions arise from swelling of the prepuce and glans.

8. *Herpes præputialis* is characterized by the appearance of small vesicles, containing an opalescent fluid; and arranged in clusters of two, three, or four, upon the internal or external surface of the prepuce. Other cutaneous eruptions, chiefly roseola, pityriasis, and psoriasis, may

be severally, concomitants of gonorrhœa; appearing, usually, from six weeks to three months after its commencement.

CONSEQUENCES OF GONORRHŒA.—1. Inflammation of the testicle, commencing as epididymitis and resulting in swelled testicle; 2. Gonorrhœal Rheumatism, and the two forms of ophthalmia,—Gonorrhœal Conjunctivitis, an acute purulent inflammation of the conjunctiva, and Gonorrhœal Scleritis, an affection of the deeper textures of the eye, allied to the rheumatic affection. 3. Prostatorrhœa or chronic inflammation of the prostate gland is an occasional consequence of gonorrhœal inflammation or of gleet. It is characterized by the discharge of a few drops of clear, transparent, or slightly turbid viscid mucus, after micturition or defæcation. This is not semen, as it contains no spermatozoa. Irritability about the neck of the bladder, and sensitiveness of the prostatic urethra in passing an instrument, are concomitant symptoms, with physical and mental languor, or hypochondriacal lowness of spirits.

TREATMENT.—The pathology of gonorrhœa supplies three general indications for its treatment, the *prevention of inflammation*; or its reduction, and then the *gradual suppression of the Chronic discharge*, or perhaps *gleet*. These indications correspond to the several stages of gonorrhœa, and they may usually be fulfilled by the following plan of treatment.

*Urethral irritation*.—During this incipient stage—lasting only from a few hours to two or three days—prevention of the inflammatory stage may perhaps be accomplished by means of “abortive” or “revulsive” measures, which comprise astringent injections, with copaiba or cubebs; but any such agents, if used for that purpose, are hazardous by perchance exciting intense inflammation.

*Inflammation—acute, and chronic*.—From the commencement of true gonorrhœal discharge, reducing, and then suppressive, measures may be employed; their nature depending on the degree of inflammation. In *acute* inflammation,—with an abundant thick opaque, yellow or creamy discharge, and scalding in passing urine; the appropriate treatment consists, in gentle saline, alkaline, aperient medicine, with an unstimulating diet, abstinence from wine, beer, or spirits, rest and recumbency. In *chronic* inflammation,—with a diminished, thinner, clearer discharge, and absence of scalding in micturition; the previous treatment may be discontinued, and followed by; acid, tonic medicines, or perhaps copaiba, cubebs, or both, and astringent urethral injections.

In *gleet*,—with a scanty, thin, clear, colourless discharge, of prolonged duration, and unaccompanied with scalding in micturition; the same suppressive measures will also be appropriate.

In accordance with the foregoing plan of treatment, I have almost invariably prescribed with success, in some thousands of cases; an aperient and alkaline mixture,—containing sulphate of magnesia, in about drachm doses, with a little senna, and the sesquicarbonates of soda and ammonia; in doses sufficient to nearly neutralize the urine. This may be taken three times a day. It may sometimes be desirable, in very acute cases, to add the potassio-tartrate of antimony, in the  $\frac{1}{12}$  of a grain dose. The urine is thus rendered less irritating to the inflamed urethra, while the inflammation itself is gradually reduced by the hydragogue operation of the aperient. By continuing this simple anti-irritant and derivative for about three weeks or more, aided by abstinence from wine, beer, spirits, and stimulating food, such as any peppers or condiments; the inflammation will most probably have *safely* subsided in that period.



The discharge has undergone the characteristic change in quantity and appearance to that of the chronic stage; and the scalding micturition has also subsided, leaving only a smarting or soreness in passing urine. Then, the discharge may be safely suppressed, gradually, by using an injection twice a day, consisting of about  $\mathfrak{z}\text{ij}$  of the liquor plumbi diacetatis to  $\mathfrak{z}\text{ij}$  of distilled water. Other injections may be resorted to; the subnitrate of bismuth and mucilage, x grs. to  $\mathfrak{z}\text{j}$  of water, with a little morphia or belladonna; sulphate of zinc, j gr., gradually increased to iv grs., to  $\mathfrak{z}\text{j}$ ; chloride of zinc, j—iv grs. to  $\mathfrak{z}\text{iv}$ ; nitrate of silver j—ij grs. to  $\mathfrak{z}\text{j}$ ; or the sulphate of zinc and acetate of lead aa. xxx grs. to  $\mathfrak{z}\text{vj}$ , an injection long in use at the old Lock Hospital. In obstinate gleet, the bichloride of mercury may prove successful;  $\frac{1}{4}$  gr. to  $\mathfrak{z}\text{j}$  of water. Any such injection is thrown up the urethra by means of a small glass syringe; and in order that it may be applied only to the affected portion of the urethral tract, the finger may be placed under the urethra, just in front of the scrotum. If the inflammation has extended further back,—to the bulb, this restriction should not be made. Bougies, covered with an ointment of nitrate of silver, or the balsam of copaiba, may be passed along the urethra; but this mode of making topical applications is not in general use. In old-standing gleet, the introduction of a bougie occasionally, even where no stricture exists, is highly beneficial. It should be of sufficient size to occupy the urethra without distension, be passed twice or thrice weekly, and left in for about ten minutes at a time.

The medicinal treatment of chronic suppurative discharge, and of gleet; comprises acid-tonics, of which, the sulphuric acid with decoction of cinchona, is most efficacious; iron, towards the close of the case, to repair the anæmic condition. Such medicinal agents as may be suitable in various constitutional conditions, must be resorted to; as in the scrofulous, rheumatic or gouty diathesis, on which a gleet discharge may seem to depend. Certain medicines have apparently some *specific* influence in arresting the discharge, and especially the two renowned specifics copaiba and cubebs. Neither should be administered when it manifestly disagrees with the system; nor continued on trial beyond a week or ten days, when no beneficial effect has been obtained by that time. Both these specifics are liable to disturb the digestive organs, and produce symptoms of irritation of the kidneys; and copaiba sometimes induces a cutaneous rash, in the form of small red patches, more or less circular, and somewhat resembling ordinary nettle-rash.

Copaiba may be administered in various preparations; in capsule, pill, draught, or extract. The capsule, an envelope or coating of gelatine containing a small bolus of copaiba, is an elegant and convenient preparation; the envelope disguising the nauseous taste and peculiar odour of the balsam. Six or eight capsules may be taken daily. In the form of pill or bolus consolidated with magnesia, copaiba sometimes acts more effectually, a drachm being taken thrice daily; or combined with dilute sulphuric acid, fifteen minims, and mucilage in infusion of roses, as a mixture, this medicinal agent is better tolerated by the stomach. Cubebs may agree when copaiba will not. The dose of the powder is a drachm, three times a day. Both these specifics are sometimes advantageously taken together, in such proportions as to form the consistence of an electuary; of which a drachm will be the dose, thrice daily. I never find it necessary to order either copaiba or cubebs, and have for some years discarded them. Hygienic measures should not be overlooked in conclud-

ing the treatment. The tepid or cold sponge-bath, with friction afterwards, sea-bathing, and open-air life, avoiding exercise on horseback; will often succeed in finishing off an otherwise long lingering case. Smoking should be prohibited.

*Chordee* is best prevented or overcome by the administration, at bedtime, of opium and camphor, j gr. to ij grs., combined in a pill; forming an anodyne antispasmodic. Conium and camphor in pill, I have often ordered with marked relief. Camphor alone may be taken, as directed by Mr. Milton; one drachm of the tincture in water, before going to bed, and repeated every time the patient wakes with chordee. Or, the suppository recommended by Ricord; opium, the watery extract, gr. j, with camphor gr. x; may be introduced into the rectum an hour before bedtime. The patient must avoid supper or any excitement before going to bed, and then bathe the parts with cold water, or preferably with warm for some time until a sensation of faintness is produced; he should lie on a hard mattress, and be lightly covered with bed-clothes.

The other *Complications*, and the *Consequences*, of Gonorrhœa, are severally noticed with regard to their Treatment, under their respective headings, in other sections of this work.

**GONORRHOEA IN THE FEMALE.**—Gonorrhœa is a much less common affection in women than in men. The seat of the inflammation and discharge is more extensive; principally affecting the vulva, or usually in conjunction, the vagina, and even extending to the cervix uteri, as well as invading the urethra. Gonorrhœa of the urethra alone, rarely occurs.

*Symptoms.*—In the vulva and vagina, the symptoms are heat and itching, with redness and swelling; soon followed by a copious, mucopurulent or purulent, and offensive discharge. The anterior wall of the vagina beneath the pubic arch is more especially the source of this discharge. But the muciparous and sebaceous follicles of the vulva become involved and pour out a copious secretion. Duverney's or Cowper's glands, upon either side of the entrance to the vagina, may become the seat of abscess. Excoriation or superficial ulceration is often presented, especially when the disease affects the os uteri.

The *diagnosis* between gonorrhœa and *simple vaginitis* cannot be determined by any one symptom, or combination of symptoms; nor by the appearances of the discharge, or its examination with the microscope. This absence of diagnostic distinction is very important in relation to medico-legal inquiry respecting supposed gonorrhœa in children and young females; who are very liable to simple vaginitis from various constitutional and local causes. Dr. West, Mr. H. Lee, and other writers have drawn particular attention to the equivocal character of the evidence in all such cases; and the diagnosis is scarcely less doubtful in vaginal or uterine discharges at any period of life.

In the *urethra*, gonorrhœa gives rise to no special symptoms; scalding in micturition, indicates that this portion of the genito-urinary mucous membrane is involved.

All the symptoms of gonorrhœa in the female are usually less severe than in the male; but they are generally of longer duration, though the discharge does not commonly pass into gleet.

*Causes.*—Gonorrhœal contagion may be simulated by vaginal or uterine inflammation and discharge, arising from other causes, constitutional and local.

*Complications.*—Inflammatory enlargement of the inguinal glands, and

almost exclusively in cases where the urethra is affected; inflammation of the cavity of the uterus, of the Fallopian tubes, or of the ovaries, the latter corresponding to epididymitis in the male; abscess of the labium, presenting on the inner side. Gonorrhœal rheumatism is a rare occurrence, and gonorrhœal ophthalmia, uncommon.

*Treatment.*—No special remedial measures are requisite, but the topical applications must be made directly to the part affected. Thus, lotions should be applied by means of lint placed well in between the labia, and injections be thrown up the vagina to reach the seat of inflammation. Unless these and similar precautions be observed, the discharge will continue in spite of any remedies, however appropriate in their nature.

### STRICTURE OF THE URETHRA.

The term Stricture of the Urethra signifies an unnatural narrowing or contraction of the canal, at one or more points in its extent. This may occur from three distinct conditions:—(1) Organic deposit in the mucous and sub-mucous tissues, of a permanent character, thence known as Organic or Permanent Stricture; (2) Spasmodic contraction of the layer of muscular fibres encircling the mucous membrane—Spasmodic Stricture; or (3) Inflammatory congestion of the mucous membrane—Inflammatory Stricture. The two latter conditions of stricture are of a temporary character, and are thus further distinguished from the first-named. They often co-exist—spasm and inflammation; and either may be engrafted, occasionally, on organic stricture.

ORGANIC OR PERMANENT STRICTURE. — *Structural conditions.* — Four forms of organic stricture of the urethra may be recognised, according to Sir H. Thompson's accurate observations:—*linear* stricture, in which the urethral canal is obstructed by a thin, membranous septum, having a central aperture; or a crescentic septum, which obstructs a segment only of the calibre of the canal; these forming the "bridle stricture;"—*annular* stricture, a thicker and broader, contracted portion of the urethral canal, as if a piece of cord had been tied around it at one point, leaving the remainder free;—*indurated annular* stricture, a more confirmed contraction, in which the induration extends into the tissues of the urethra to the depth of half a line or a line, but limited in extent from before backwards to less than half an inch of the canal, and presenting an hour-glass contraction, usually thicker on the floor than at the upper aspect of the urethra;—*tortuous* or irregular stricture, owing apparently to adhesion of the rugæ of the urethra, to a short extent, or to a cicatricial patch of induration, or a longitudinal contraction and induration to an extent of one or more inches. In this condition of stricture, the induration may involve the entire substance of the corpus spongiosum, presenting the most obstinate and undilatable form of stricture.

*Situation of Stricture.*—The urethral canal is liable to stricture in three situations:—(1) At the junction of the spongy and membranous portions; or within an inch before, and three-quarters of an inch behind, that point. Of these situations, the most common seat of stricture is the bulbous part of the spongy portion—anterior to the triangular ligament, rarely, behind this membrane, in the membranous portion, and most rarely as far back as the posterior part of the membranous portion. No instance has been found of stricture in the prostatic portion of the urethra. The above strictures correspond to the sub-pubic curvature.



(2) In the centre of the spongy portion, or that portion of the urethra which extends from the anterior limit of the preceeding to within two inches and a half of the external meatus, a length of about three inches.

(3) At the external orifice, and within a distance of two inches and a half of it.

These definitions as to the situation of urethral stricture result from a laborious examination by Sir H. Thompson, of 270 preparations in our principal public museums, and comprising 320 distinct strictures. In region (1) were found 215, or 67 per cent. of the entire number; in region (2), 51, or 16 per cent.; in region (3), 54, or 17 per cent. Mr. H. Smith made a similar investigation of this question, on a smaller scale; the preparations numbering 98, as preserved in the different London museums. Of these, 77 were strictures situated anterior to the triangular ligament; and 21 only, in the membranous portion of the urethra.

*Several* strictures may co-exist in the same urethra; John Hunter records an instance of six strictures in one urethra; Lallemand and other French writers describe seven or eight; Sir H. Thompson has never been able to find any such examples, and he limits the highest number of co-existing strictures to three, or the most four. In the above number of 270 preparations, 8 were cases of stricture in all three regions; 10 in regions 1 and 2 only; 10 in regions 1 and 3 only; 13 in regions 2 and 3 only.

*Symptoms.*—The urethral obstruction occasioned by stricture gives rise to symptoms which are individually, or collectively, significant of this condition. Increased frequency of micturition arises, owing to the inability to completely empty the bladder; the stream of urine becomes smaller than is natural to the individual, and altered in form, either flattened, twisted or cork-screwed, forked, or turned aside; and discharged with a less forcible propulsion, so that the current is not ejected as far from the person as formerly, and at length issues as a mere dribbling or in drops.

As the obstruction *increases*, the muscular coat of the bladder gradually strengthens and hypertrophies, in order to compensate for the difficulty in ejecting the urine through the strictured urethra; and as this thickening of the bladder proceeds, its capacity is proportionably diminished, less urine can be retained, and micturition must be even more frequent. This state, annoying and inconvenient during the day, is distressing at night, when exhaustion would invite to rest; the sufferer being repeatedly aroused from his temporary doze, and the night passed in restless efforts to obtain relief. After each act of micturition is apparently completed, another significant symptom is experienced; a certain portion of urine still escapes as a dribbling leakage, owing to the propulsive force of the remaining urine being insufficient to overcome the resistance of the stricture, which was dilated by the stream passing when the bladder was full. After the act of micturition is actually quite finished, a certain portion of urine can sometimes be squeezed out by pressure behind the seat of stricture, from the dilatation of the urethra in that situation. Pain is usually felt in the canal behind the stricture, during the effort to pass urine; and by constant straining, some feculent matter or flatus escapes at such times, and a tendency to prolapsus of the bowel is established. In a paroxysm of straining effort, rupture of the urethra may occur, behind the stricture; and then extravasation of urine takes place into the cellular texture of the perineum, scrotum, and supra-pubic region. In the act of coitus, much pain is experienced about the ejaculatory

ducts; and, as the semen escapes with difficulty through the urethra but passes back into the bladder, there may be no seminal emission; and the unhappy patient believes himself actually, as he may be virtually, impotent. The urine undergoes those changes which result from chronic cystitis, consequent on retention. It becomes ammoniacal, cloudy, and deposits more or less mucus and pus, with phosphates. Hæmaturia is an occasional concomitant of stricture; the blood coming from the mucous membrane of the bladder, or perhaps from the urethra after catheterism or an erection of the penis affecting the seat of stricture. A gleet discharge not unfrequently attends old stricture of the urethra.

The general health fails, the patient losing flesh and strength; he has an anxious and careworn appearance, suffers from pains in the loins, lower part of the belly, the perineum and testicles; and is subject to severe attacks of rigors. Any irritation of the urethra, as by passing an instrument or the application of an irritant substance, will often provoke such an attack, especially in those who have lived in hot climates, or it not uncommonly excites general feverishness—hence named “urethral fever,” and which has sometimes an intermittent character.

Certain *varieties* of organic stricture may be recognised by some peculiarity of their respective symptoms.

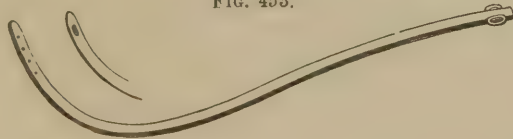
*Simple* stricture; chiefly denoted by diminution in the size of the stream of urine and the other ordinary symptoms of stricture.

*Sensitive or irritable* stricture.—Proneness to disturbance of the nervous system, as manifested by chilliness or rigors on very slight urethral irritation; and pain, sometimes persistent, from the gentlest passage of an instrument. A disposition to hæmorrhage is evinced in a few cases.

*Contractile or recurring* stricture—distinguished by a constant tendency to further diminution of the urethral canal, in the absence of treatment; and contraction recurs rapidly after dilatation has been effected.

*Examination of the Urethra.*—Catheterism supplies the most direct and conclusive evidence as to the existence of stricture; evidence analogous to that of sounding for stone in the bladder. The presence of stricture, its situation, its calibre, the extent of the canal involved, and the amount of induration, may be thus severally determined; and whether also there be one or more strictures. Instruments of various composition and form are used for this purpose; catheters, which may be inflexible as the ordinary silver instrument, or flexible gum-catheters; and bougies which are solid instruments of flexible metal, or flexible and elastic, as the ordinary gum-elastic bougie, wax, or catgut bougies. Generally, an inflexible instrument is to be preferred (Fig. 453); its point taking the

FIG. 453.



direction of the urethra more certainly, and being more accurately under the control of the hand at the other end of the instrument. Catheters and bougies may be curved or straight. The former shape is generally applicable; and the curve most commonly suitable, is that which corresponds most nearly with the bend of the urethra at its inner third—an

arch rather less than one-fourth of the circumference of a circle  $3\frac{1}{4}$  inches in diameter. (See Fig. 453). Straight instruments are preferable only for strictures in the ante-scutal portion of the urethra.

The *bougie olivarie* possesses two advantages; a bulbous or spear-headed end, and flexibility; it can, therefore, be insinuated, or passed with a screw-like action, into a tight stricture, and readily takes the course of an irregular urethra,—without causing pain, hæmorrhage, spasm, or rigors. This instrument, originally advocated by Mr. Teevan, in this country, is now much used.

The *introduction of a catheter* may be performed in either of two ways; in the recumbent position, and with the curve of the instrument directed upwards; or in a standing position, and with the curve of the instrument looking downwards. Of these two methods, the former is usually more easy and convenient both to the patient and Surgeon. The patient lying down on his back, with the shoulders a little raised, the legs thrown easily apart, and slightly drawn up; an instrument of appropriate size—number 7 or 8—is selected, and warmed by a little friction up the sleeve for a few seconds, and then oiled or smeared with lard. In introducing it, the handle should be held lightly between the thumb and the fore and middle fingers of the right hand—the concavity of the curve looking upwards towards the left groin of the patient, and the direction of the instrument being nearly horizontal. Raising the end of the penis with the thumb and finger of the left hand, so as to draw it up to its full length; the double curve of the urethral passage, somewhat resembling an italic *S*, is thus changed into one curve, commencing from just in front of the scrotum; and this single curve corresponds to the curve of the instrument, as it passes along the urethra from that point downwards and upwards into the bladder. The point of the instrument—held as directed—is now inserted into the urethral meatus and carried slowly onwards along the floor of the canal—to avoid the lacuna on its roof, until four or five inches have disappeared; the handle is brought, at the same time, to the middle line, but still parallel and near the patient's abdomen; then it should be gently raised, and as the point of the instrument passes under the sub-pubic curve, the handle is carried forwards and lightly depressed until it sinks below the horizontal line, when the opposite end will turn upwards into the bladder. When the point of the instrument has passed below the scrotum, its further progress in the right direction may be facilitated or maintained, by guiding it between the fore and middle fingers of the left hand, under the pubes; and sometimes, the introduction of the fore-finger into the rectum will aid in determining the middle line onwards to the bladder. Any slight resistance may be obviated by manipulating the instrument, in respect to its direction, or withdrawing it for an inch or so, and then re-passing it. But the presence of *stricture* is determined by an arrest of the instrument point blank, and at the same part of the urethra on each re-introduction. Remembering the situations of stricture, this obstruction will be found usually behind the scrotum, in the sub-pubic curvature; less frequently in the ante-scutal portion of the urethra. No force should ever be used, nothing more than the pressure of a light hand, exercised slowly, and with patience. Any departure from this injunction may lead to perforation of the urethra and the formation of a “false-passage;” and this misadventure is the more likely to happen when the handle of the instrument is being depressed, whereby the shaft acts as a powerful lever on the point in the urethral passage.



The other method of introducing a catheter—when the patient stands upright, is performed in the *opposite* manner to that in the recumbent position. It is the “*tour de maitre*” of French authors. The patient standing with his back to a wall, so that the nates shall not recede during the procedure, and with his legs a little apart; the instrument is introduced with the curve looking downwards, and the handle in a perpendicular line beneath, the penis being drawn straight forward. Having passed the instrument in this direction as far as the sub-pubic arch; it is swept round to the right and raised upon the abdomen, thus describing a semicircle, of which the catheter-point is the centre; then the handle is gradually depressed, so as to carry the point of the instrument through the sub-pubic curve into the bladder.

The *existence* of stricture having been ascertained by the obstruction offered, at some point, to the introduction of a catheter along the urethra; its *situation* may be estimated by feeling the end of the instrument behind the scrotum, or in front as the case may be, and noted more accurately by the length of the instrument passed from the external meatus (Fig. 454). The *degree* of contraction or the calibre of the canal at that point can be estimated by the size, or number, of the instrument used; the *extent* of the canal involved, by the length of the instrument “held” or “grasped” from the point of entering the narrowed portion of the urethra; while, at the same time, the amount of *induration* may be judged of by an experienced tact. A second or third stricture is discovered in like manner, by continuing the urethral examination

FIG. 454.



To complete the examination of any one or more strictures, several instruments, of different sizes, will perhaps be necessary. Five of the sizes in common use, are here represented; the outer circle of each indicating the diameter of the instrument. (Fig. 455.) Number 7 or 8 size should always be tried first; a smaller-sized instrument is liable to hitch in one of the urethral lacunæ, or against the verumontanum, or in the sinus pocularis, as if it were fixed in the stricture; or it might pass through the stricture imperceptibly. Either occurrence would mislead the Surgeon. The smaller the instrument used the greater caution and delicacy must be observed in using it; lest incautiously the urethra be perforated. A soft *wax-bougie* has been recommended with the view of taking an impression or mould of the size and extent of the stricture. Any such supposed advantage is more than neutralized by the difficulty of finding the

FIG. 455.



stricture, as compared with the facility in using an inflexible instrument.

*Causes.*—Two classes of causes may be recognised as resulting in the formation of an organic stricture.

(1) Inflammation of the urethra with *plastic deposit* in the mucous and sub-mucous tissues; thereby glueing together the organic muscular layer which immediately underlies the mucous membrane, and in virtue of which the canal naturally undergoes temporary alterations of calibre, by relaxation or contraction. This kind of cause comprises gonorrhœa; the inflammation extending along the canal, and being of a severe or long-continued character. The symptoms of stricture supervene very slowly and insidiously; a period of many years perhaps elapsing before the existence of this organic constriction is declared. Simple urethritis may have the same result, but only under the operation of some persistent constitutional condition. Injections for the cure of gonorrhœa tend to the formation of stricture; when used in the inflammatory stage, or of too great strength, or long continued. Thus, an injection of nitrate of silver,  $j$  to  $ij$  grs. to  $\bar{3}j$  of water, can do no harm; but in the proportion of  $x$  grs. to  $\bar{3}j$ , it may certainly produce stricture. Abscess in a lacuna of the urethra followed by contraction of the *cicatrix*, is an occasional cause; and cancerous or other ulcers may similarly result in the formation of stricture, usually near the external meatus; amputation of the penis sometimes issues in like manner.

(2) Injury to the urethra by external violence on the perineum, bruising, lacerating, or rupturing the urethra, is followed by a *cicatrix*, the contraction of which may result in stricture of the most severe and intractable character. This kind of cause comprises, blows or kicks on the perineum, falls on some hard projection, as across spars, scaffolding, ladders, chairs, gates, wheels, saddles, &c.; puncture of the perineum, by palisading, by an earthenware vessel breaking under the sitter, &c.; laceration, by pelvic fractures involving the urethra; and lastly, by the forcible introduction of urethral instruments.

*Congenital* stricture is occasionally met with, near the external meatus; in early life, its existence is unattended by any inconvenience; but in adult life, it gives rise to serious obstruction to the passage of urine, when the urethral tissue has become less extensible.

*Consequences, and Terminations.*—The course of stricture is very similar to that of chronic enlargement of the prostate. *Chronic* cystitis or a state of the bladder bordering on it, commonly ensues from the habitual retention of urine and distension of the bladder. The characters of the *urine* are in accordance with that condition. The *general health gradually declines*; as the result of broken rest from ineffectually relieving the bladder, and of constitutional disturbance owing to the state of the organ, aggravated by occasional attacks of *spasmodic retention*; or the constitutional symptoms may be those of increasing *nervous prostration* with oft-repeated rigors, induced sometimes by each act of micturition, or simply by the introduction of an instrument; and *rapid depression* may supervene, either from ulceration or sloughing of the bladder with recurring hæmorrhage, or from profuse purulent discharge. *Rupture of the urethra* is liable to occur, owing to dilatation and ulcerative opening of the canal immediately behind the stricture; followed by *extravasation of urine* with its attendant symptoms. Rupture of the *bladder* is a very rare event. Both these consequences of Stricture are dependent on Retention of Urine,

and they will be noticed under the head of Extravasation of Urine. *Suppression of urine*, with uræmia, sometimes occurs from slight urethral irritation; as by the introduction of an instrument only one size, or number, larger than that to which the patient is accustomed, or in consequence of a slight urethral abrasion, or from the mere passage of an instrument. Severe rigors and suppression of urine are both far more apt to occur when disease of the kidneys exists, so that the one becomes a tolerably sure indication of the other; and the fatal issue is more rapid and inevitable.

Certain *pathological conditions* of the urethra, bladder, ureters, and kidneys, result from the mechanical effect of long-continued retention of urine. They are discovered *after death*. The *urethra* becomes contracted in calibre before, and dilated sometimes into a sacculus just behind, the seat of stricture. In the latter, or dilated pouch, sabulous matter and even calcareous concretions, occasionally collect. Rupture of the urethra may have taken place in this dilated portion; and in connexion with an abscess, usually perineal. The ejaculatory ducts also, opening into the sinus pocularis, are liable to become enlarged. The *bladder*, subjected to the constant backward pressure of urine, which distends its cavity, becomes fasciculated internally, and perhaps sacculated; the one alteration of this organ representing an hypertrophied state of its muscular bands, the other, intervening protrusion of the mucous membrane. The general result is a diminution in the capacity of the bladder for the retention of urine. (Fig. 456.) Rupture of this organ may have occurred, though very rarely. The *ureters* have undergone dilatation by the tendency to reflux of urine, and the pelvis of these tubes may be much enlarged; the *kidneys* also have become more or less atrophied in their pyramidal and cortical portions, resulting perhaps in sacculated remnant kidneys, or in the formation of mere bags. Hence, the suppression of urinary secretion, and uræmic blood-poisoning. Sometimes, the bladder may have ruptured under prolonged retention of urine, in consequence of a small pin-hole aperture of ulceration in the mucous membrane of one of the sacculi.

*Treatment.*—The object of treatment is two-fold; to restore the urethral canal to its natural calibre, and to maintain that state of patency.

But for the accomplishment of this object, different modes of treatment are necessary according to the various states of stricture; its degree of contraction, and induration, its dilatability, its sensitiveness and proneness to disturbance of the nervous system, its contractility and disposition to recurrence. All the modes of treatment may be reduced to four; (1) Gradual Mechanical Dilatation; (2) Immediate and Forcible Dilatation,

FIG. 456.





or Rupture; (3) Caustics; (4) Division of the Stricture, either by internal urethrotomy, or by external urethrotomy,—usually perineal section.

GRADUAL MECHANICAL DILATATION,—inducing absorption of the plastic deposit around the seat of stricture. This method of treatment is most generally applicable; the other methods being resorted to when it proves ineffective, or when it is contra-indicated by one of the adverse states of stricture above mentioned.

The *instruments* used for gradual dilatation are catheters, sounds, and bougies,—inflexible, or flexible and elastic; and always of gradually increasing size. Metallic instruments will be preferable in most cases, and none are more effective than the ordinary silver catheters.

The selection of an appropriate instrument, in respect to its size and curve, will depend on the degree of contraction and the situation of the stricture; both these points having been determined by urethral exploration with a catheter, sound, or bougie, as already explained in completing the diagnosis of stricture. A catheter is generally preferable even for *that* purpose; for not unfrequently the patient first seeks relief when suffering from an attack of retention, and the Surgeon having succeeded in getting an instrument into the bladder, may be very glad to leave it there.

The introduction of a catheter may be performed in either of the two ways already described; and according to the directions given. An instrument of such size only should be used as shall be found to enter the stricture easily, and can pass fairly through it without feeling tightly held by the contraction. Dilatation is then effected by leaving the instrument in this contracted portion of the canal; so as to continue the slight expansion, and induce absorption of the plastic deposit in the mucous and sub-mucous tissues forming the stricture. The *period* for maintaining the dilatation is about five minutes,—some say twenty minutes; then the instrument should be withdrawn, and its size, or number, noted, as a standard of comparison in the subsequent introduction of gradually larger-sized instruments. This procedure should be *repeated* every two or three days. But the intervals of catheterization must be regulated by the state of the urethra, and the constitutional disturbance induced. When bleeding, pain or smarting in micturition, follow or continue after the operation—events very likely to happen after the first passage of an instrument through the stricture; further dilatation must be postponed for a day or two, until this urethral condition has subsided. Shivering, faintness, or sickness, may also supervene, especially under similar circumstances; postponing any re-introduction of an instrument until this state of constitutional disturbance has passed off. Chloroform, therefore, often becomes an invaluable agent in the treatment of tight stricture by dilatation.

This plan of treatment must be prolonged until the urethral canal is restored to its natural size, and the stream of urine fully established. The urethra may then admit a catheter of full-size,—number 12, with ease; when it should be passed less frequently, once in a week or ten days. Lastly, it will be necessary to maintain the patency of the canal, by an occasional use of the instrument once in a month or six weeks.

In the course of treatment by gradual dilatation, the general health should be attended to; especially with regard to the digestive organs, and the state of the skin and kidneys.

*Continuous* dilatation may be advantageously resorted to when the stricture proves obstinate under the ordinary plan of gradual dilatation. The principle is that of rapid dilatation and dissolution of the stricture,

by retaining the instrument in the contracted portion of the canal for a period varying from forty-eight to seventy-two hours, at a time. The catheter is fastened by means of tapes passed through the eyes of the instrument, on either side, and thence under the buttocks and over the thighs to a waist-band. If a gum-catheter be used, it can be secured by a strip of adhesive plaster to the penis. A peg of wood or bit of cork is inserted into the orifice of the catheter, and the water drawn off as occasion requires.

In the management of this process, three points must be observed:—the catheter should occupy the stricture, without fitting tightly or being grasped by it; the instrument, when tied in, should not project against the interior of the bladder; and after using a silver instrument on the first occasion, the succeeding instrument may be gum-elastic, as causing less irritation.

When, in about forty-eight hours, the catheter has become loosened in the stricture, and a slight purulent discharge has taken place around the instrument; it should be withdrawn. In two or three days, this procedure is renewed, and an instrument larger by two or three sizes may be at once introduced; and so on until a full-sized one can be passed easily. Re-contraction must then be prevented by occasionally passing an instrument, at gradually increasing intervals of time.

*Difficulties and Accidents in Catheterism.*—*Induration* or hardening of the stricture sometimes presents considerable difficulty to insertion of the point of the instrument. This may perhaps be overcome by using a conical-shape pointed catheter. But, if the stricture be not very sensitive, continued pressure on the face of the induration will probably cause the stricture to yield. Injecting the urethra with four or five drachms of olive oil seems to exercise an hydraulic pressure on the stricture by penetration of the fluid into the narrowed passage.

*Spasmodic* action must be overcome by the means appropriate for spasmodic stricture.

*False passage.*—A false passage, or a passage leading out of the natural urethral canal, is made by forcible and misdirected pressure with the point of any instrument in its course through the urethra. The passage, therefore, usually takes a direction downwards and backwards, and to one side of the urethral passage; in an opposite direction to the stream of urine, the free discharge of which remains unaffected. An inflexible instrument, as the ordinary silver catheter, will be more apt to cause misadventure than a flexible instrument; but the latter is more liable to enter a false passage already existing.

The previous existence of such a passage or passages is perhaps the most common and perplexing occasion of difficulty in using an instrument; and its production, an accident most to be avoided. The importance of these considerations in relation to catheterism, lies in the fact that the difficulty of entering the right opening, is increased by the facility with which the instrument slips into the wrong one.

A false passage varies in its *situation* and *extent*. When the stricture is far forwards, the passage may run in the corpus spongiosum; when further backwards, in the usual situation, the passage may perforate the lateral lobe of the prostate or run up between it and the rectum; this latter direction being especially dangerous. The *floor* of the urethra is most commonly the seat of a false passage; and it is most liable to happen in connexion with a tight stricture, and the introduction of a small-sized instrument. Hence, in the treatment of such a stricture more particularly, and when it has been subjected to the previous use of instruments;

an important practical injunction in passing the catheter is this,—the point of the instrument should be kept against the roof or *upper surface* of the urethral canal.

Certain *signs* at once indicate to the Surgeon that a false passage has been commenced, or entered if pre-existing. The point of the instrument is felt to make a sudden slip, and the shaft inclines to one side of the urethra; the point also feels free and moveable, and communicates a rough or grating sensation, while it can be easily withdrawn; all these peculiarities being more notable when occurring after the instrument had been felt to be held or grasped by the stricture. The patient experiences sudden and severe pain, and is often conscious that something has given way; on withdrawing the instrument, it is found besmeared with blood, and there will be free hæmorrhage from the urethra.

*Hæmorrhage* must, therefore, be regarded as another accident attending catheterism; but it is also liable to occur independently of any urethral lesion, from the mere passage of an instrument, in inflammatory stricture.

*Inflammation* affecting the urethra or testes may be induced by dilatation; especially with instruments of too large a size, or rapidly increased.

Other evil concomitants, or consequences, have already been alluded to; pain in micturition, rigors, faintness, sickness.

Gradual dilatation having proved ineffective for the cure of stricture, other methods of treatment must be resorted to; and they are especially applicable, when either the sensitive state of the stricture or its contractile and recurring tendency would render that mode of treatment inapplicable, as being intolerable or unsuccessful. The degree of tightness of the stricture and the amount of induration, together representing an undilatable state of stricture, will be found to determine the particular mode of treatment then appropriate;—whether Forcible Dilatation or Rupture, or Division by incision, internally or externally.

**IMMEDIATE AND FORCIBLE DILATATION, OR RUPTURE.**—In estimating the applicability, and advantage, of this method of treatment for stricture of the urethra; it would certainly appear that the vital character and constitutional relations of the urethral tube should forbid any dilatation of an immediate and forcible character; and still more so any rupture of its component tissues. Yet experience has now shown that not only may this mode of treatment be practised with impunity; but, that a tight stricture undilatable gradually, beyond a certain degree, and any further distension of which would excite severe constitutional disturbance, may be forcibly dilated or ruptured up to the natural size of the urethra and without producing any such symptoms.

Forcible dilatation is effected by means of *distending instruments*, which when passed through the stricture exert an expanding force from within outwards. Such force may be accomplished by a *series* of instruments, consisting of sliding tubes, passed successively over a slender urethral director or guide, which is first passed through the stricture; or, it may be effected by means of a *single* instrument which expands *in situ*.

*Sliding tubes* were originally employed by Desault (1797), and afterwards by Dr. Buchanan of Glasgow (1831), Dr. Hutton of Dublin (1835), and by Maisonneuve (1845). Mr. Thomas Wakley, of the Royal Free Hospital, with whom this mode of treatment was originally identified in this country, contrived a series of accurately-fitting tubes and an urethral director. This having been first passed through the stricture, each sliding-tube, in succession, cannot fail to take the same course. The



difficulty, and the risk, will always be to first introduce the slender director through a tight stricture; a difficulty proportionate to the degree of contraction, and the existence of false passages, or the liability of making them. *Single* instruments of various kinds have been devised, which expand *in situ*, in the place of several instruments of increasing calibre: and thus save the necessity of passing them successively through the constricted part of the urethra. With this object, Mr. Luxmore (1812) employed diverging metal rods; Leroy d'Etiolles the same method, some years later, and Perrève a somewhat similar plan (1847). Dr. Neil Arnott, on the same principle, commenced the employment of fluid expansion (1819). Both these forms of contrivance,—the series of sliding-tubes and the single expanding instruments, have a similar action upon the urethra,—distension of the contracted portion from within its area. They thus differ from the large conical metallic bougie formerly used for the purpose of forcible dilatation, which was driven into the stricture; thereby running the risk of pushing the stricture down the canal and detaching its connexions, and inevitably inducing inflammation and severe constitutional disturbance.

*Rupture or Splitting of the Urethra.*—Mr. Holt has recently revived this mode of forcibly opening stricture of the urethra. It seems to be most applicable to tight stricture, without much induration; so that the plastic deposit does not form a mass too thick or dense to be entirely ruptured. Rupture may, therefore, possibly supersede the necessity for division by a cutting operation.

The “dilator” used by Mr. Holt is precisely similar to that of Perrève. Its construction, and his mode of operating, he thus describes:—The instrument consists of two grooved blades fixed in a divided handle, and containing between them a wire welded to their points; on this wire a tube—which when introduced between the blades corresponds to the natural calibre of the urethra—is quickly passed, and thus ruptures or splits the obstruction. Having introduced it, and reached the bladder, the dilator should be gently rotated, to prove that it is fairly within that viscus; and being thus assured, the Surgeon is next to place the point of the tube he had previously selected, upon the wire between the blades, and thrust it quickly onwards to the end. The stricture being now fairly split the dilator should be rotated, to still further separate the sides of the rent, and then be withdrawn; a catheter corresponding to the number of the tube being substituted for the purpose of removing the urine. The catheter is then withdrawn, the patient treated with quinine and opium for the first twenty-four hours; and the same catheter introduced in forty-eight hours; and again on alternate days for a week or two, gradually lengthening the interval.

The *results* of this procedure in the hands of Mr. Holt have been eminently successful; and the experience of other Surgeons has generally confirmed its value. I have not seen much constitutional disturbance follow the operation of splitting the urethra; but in one case, operated on in another Hospital, extravasation of urine ensued, for which I treated the patient at the Royal Free Hospital, and he recovered. Many deaths, however, have I believe ensued,—Mr. Teevan says fifteen in number, which have not been recorded in the Reports of Cases hitherto published. It would also be very desirable to diagnose more correctly the *pathological conditions* of stricture operated on,—if indeed they can always be determined clinically; since it will be obvious that the mere splitting up a number,

say some scores, of urethræ, many of which were perhaps scarcely strictures at all, can have nothing to do with the propriety or eligibility of this mode of treatment. The splitting of urethræ, in almost a *healthy* state, would necessarily swell the resultant proportion of, apparently, successful cases.

Sir H. Thompson has contrived a *distending* instrument for this operation, and which seems to possess three advantages:—distension of the stricture alone is accomplished, without involving the healthy portion of the urethra in its action, the distension can be carried to a calibre of 14 or 16 of the catheter scale, beyond the size which the external meatus will admit, and is thus more efficient; and the distending force is applied very slowly, continuing from seven to ten minutes before reaching the maximum point of distension,—the object being to overstretch the morbid tissues as much, and to rupture them as little, as possible, in order to destroy, or greatly impair, the natural tendency of the stricture to undergo contraction.

CAUSTICS.—Cauterization, in the treatment of stricture, has been practised with two objects in view; the destruction of induration, and the deadening of sensibility or spasm; in both ways permitting subsequent recourse to dilatation. It may be effected by the introduction of an instrument armed with caustic, such as nitrate of silver or potassa fusa, which is carried down to, and allowed to rest against, the stricture, for two or three minutes. A gleet discharge is thus established, and the caustic re-applied every two or three days until a catheter can be passed, and gradual dilatation made to complete the cure.

This method of treatment was formerly in vogue, and still, I believe, has one or two advocates in this country; but the experience of the best Surgeons both here and in France has condemned it, as being both perilous, and extremely uncertain in its results. Stigmatized by Mr. Liston, as “most atrocious,” and discountenanced more recently by Nélaton; the cure of stricture can always be accomplished more safely, and with greater probability of non-recurrence. Cauterization has, therefore, now fallen into general disuse.

DIVISION OF THE STRICTURE.—Section of the urethra may be appropriately resorted to in tight stricture, with considerable induration; forming perhaps a large and hard nodule, unfitted for rupture. This can be effected by incision; either from within the urethra; or from without, and usually in the perineum.

(1) *Internal Urethrotomy*.—Division of the stricture from within the urethra, has been practised for above a century. Allies of France (1755); Physick of Philadelphia (1795), John Bell (1806), and his brother Charles Bell (1807), McGhie (1823), and Stafford (1827); have severally advocated this method of treatment. It has been practised extensively in France, especially by Civiale; and occasionally by modern Surgeons in this country.

The operation may be performed in two ways;—*incision from before backwards*,—section being made by pushing downwards a lancet-like blade, generally with a slender conductor in advance of it, into the obstruction to be divided; *incision from behind forwards*,—a portion of the instrument containing a small blade, sheathed, is first carried down through the stricture, which is then divided by protruding the blade and withdrawing it through the whole of the contracted portion. Various instruments, or *urethrotomes*, have been constructed for the internal division

of strictured urethra. Stafford's lancet-catheter (Fig. 457) may be used; the point, indicated by the dotted lines, is concealed in the tube until the end of the instrument rests upon the stricture, it is then projected through the obstruction. A curved, as well as the straight form of this

FIG. 457.



instrument, has been employed. For incision from before backwards; Sir H. Thompson's catheter-urethrotome, or Mr. John Wood's instrument, are applicable; for incision from behind forwards, Civiale's urethrotome is the best form of instrument. After either mode of operation, a full-sized catheter must be introduced, and retained for twenty-four hours. An instrument should also be passed occasionally, for some time, to prevent re-contraction.

The results of internal urethrotomy are satisfactory as regards the immediate restoration of the urethral canal to its natural calibre; the ultimate result may be permanent, or evince a tendency to the return of stricture,—generally, however, amenable to dilatation. It should also be observed that in both modes of internal urethrotomy, the strictured portion of the canal must be already sufficiently large to admit an instrument, equal in size to a number 4 or 5 catheter; and that with this degree of patency, it may well be considered probable that further and perhaps complete enlargement can be accomplished by dilatation.

(2) *External Urethrotomy*.—Division of the stricture by external incision is an alternative operation of urethrotomy, the earliest instance of which for the cure of stricture, is recorded by Wiseman (1652). A few years afterwards, Solingen, at Livourne, adopted this procedure; followed by François Tolet and Colet (1690). J. A. Petit, and Ledran (1740), had recourse to a similar operation; and John Hunter (1783), performed the operation now known as the perineal section; but it was rarely employed until advocated by Mr. Grainger of Birmingham (1815), and afterwards by Mr. Arnott. These operations refer to cases in which no instrument could be passed through the stricture. More recently (1844), Mr. Syme has advocated external division of the stricture in cases where, although a catheter can be passed, no other treatment has afforded sufficient or permanent relief.

*Perineal section*, as the operation of external division of the stricture may be generally designated, is applicable in two degrees of extreme urethral contraction:—permeable stricture, through which a slender grooved staff can be passed, and the external incision made upon this instrument; and impermeable stricture, through which no instrument apparently can be passed, the only guide being a full-sized instrument passed down to the stricture, towards the point of which the external incision is directed.

The condition of stricture appropriate for perineal section, is that of considerable, even cartilaginous, induration, both in thickness and extent, appreciable usually by external examination with the finger; coupled perhaps with perineal fistulæ, either chronic or numerous.

(a) *Permeable Stricture*.—Perineal section, by Syme's operation, is



performed as follows:—The instruments required are; a staff, slender, slightly curved, and well grooved in its lower half, and the upper of full size; a pointed scalpel, a broad director, and a silver catheter, number 8, or 10. The staff is passed *through* the stricture, so that the shoulder or termination of the upper thick portion rests against the upper part or face of the stricture. The patient is tied up as for lithotomy, and the staff held in like manner by an assistant, with the scrotum drawn forwards. The Surgeon, sitting in front, makes an incision in the raphé or median line of the perineum, about two inches in extent, and proceeds cautiously straight to the shoulder of the staff; feeling his way with the fore-finger of the left hand. Having clearly reached that point, he takes the staff from the assistant in his left hand, and enters the point of the knife in its groove, *behind* the stricture; thence cutting upwards to the shoulder of the instrument until it can be passed onwards into the bladder. This instrument is then withdrawn, and the number 8 catheter introduced and retained for forty-eight hours. Subsequently a full-sized catheter should be passed every three or four days, and afterwards at longer intervals, to prevent re-contraction. Difficulty in introducing the catheter, after withdrawing the staff, may be obviated by first passing the director into the urethral wound, along which, as a guide, the catheter glides into the bladder. Instead of using a catheter, Mr. Syme prefers at first to pass a tube through the wound into the bladder in order to guard the wound as much as possible from contact with urine.

The following directions are given by Mr. Syme, as essential to the success of this operation:—1. Maintain the median line in the incisions. 2. Make a direct opening down to the staff, not a tortuous one. 3. Divide the whole of the contracted part, rather more than less. 4. Do not cut so far back as to endanger the deep fascia of the perineum, and use the knife in the deep incisions with the cutting-edge uppermost. 5. Do not close the end of the inlying catheter, lest urine be forced into or through the wound, for want of patency in the instrument. 6. Avoid escape or displacement of the instrument. 7. If incisions are made far back, introduce a curved tube through the wound when the catheter is withdrawn. 8. Do not neglect dilatation during the progress of recovery.

(b) *Impermeable Stricture*.—This condition of stricture is very rare, if it ever exists. As Syme justly observes, any stricture through which urine can escape, will admit an instrument to be passed with care and patience. Then, of course, the operation may be performed as for permeable stricture. Otherwise, a catheter of full size, having been passed down to the stricture, and held there firmly by an assistant, perineal section is performed; the point of the instrument being the guide to, but not through, the stricture. Having clearly reached that point, the Surgeon endeavours to pass a small grooved director through, or partly through, the stricture; and on this instrument he at once divides, or successively pursues, the track of the contracted canal. When no director, however small, can be introduced, the urethral canal must be followed without any such guide, by dissection alone cautiously conducted. In either case, as soon as the continuity of the passage is restored, the catheter above is to be carried on into the bladder, and retained in the usual manner for a period of some days.

*Results of Perineal Section*.—The latter operation of external incision,—without an urethral guide, is of course hazardous and uncertain in its results. But external incision, as performed on a grooved staff, has

yielded excellent results,—in an appropriate condition of stricture, and when the operation has been properly performed. Among 219 cases of this operation, collected with scrupulous care by Sir H. Thompson, there was a mortality of between 6 and 7 per cent. Of this percentage, nearly two-thirds died of pyæmia, the remainder, one or two only excepted, from fever and suppression of urine. Such a mortality is not large, considering the extreme cases of stricture and broken constitutions, subjected to the operation.

The *pathological conditions* of stricture submitted to operation, will of course materially affect the proportionate result of apparently successful cases. Perineal section is appropriate for the condition—originally proposed—an almost impermeable stricture, and which is otherwise incurable by dilatation,—and this is always implied, when *properly* speaking of the operation and its results; but I have seen perineal section performed when, at the time of operation, a full-sized catheter had just before been passed, easily, into the bladder,—and the operation having been performed simply for extravasation of urine.

SPASMODIC STRICTURE.—This kind of stricture is due to the spasmodic action of the muscles surrounding the urethra, and is of a temporary character. It rarely occurs alone, but usually as a supervention on organic stricture, or in connexion with an inflamed state of the urethral canal. Spasmodic stricture may occur at any portion of the urethra, by contraction of the layer of involuntary muscular fibres which encircle it throughout its course; or the membranous portion of the urethra may be constricted by spasm of the compressor urethræ muscle, acting as a sphincter on this portion of the passage, and this is the usual seat of spasmodic stricture of the urethra.

The *symptoms* are those of obstruction to the passage of the stream of urine, but of temporary duration although perhaps oft-recurring. They thus differ from the same symptoms in organic or permanent stricture.

*Causes.*—Local and urethral conditions, or remote and constitutional conditions, may severally give rise to spasmodic stricture. The first class comprises, chiefly;—the presence of organic stricture; of inflammation from suppressed gonorrhœal discharge; irritation of the urethral mucous membrane from various states of the urine, especially a highly acid state, with various constitutional conditions, as gout; foreign matters ingested and expelled by the urine, as cantharides, turpentine, condiments, alcoholic drinks; and the voluntary retention of urine for too long a time. The second class of causes, comprises, chiefly:—rectal irritations; as hæmorrhoids, fissure, prolapsus, fistulæ, operations on the rectum, ascarides, and anal prurigo; derangements of the digestive organs, and of the cerebro-spinal system. The *social* circumstances under which the practitioner will commonly meet with spasmodic stricture are characteristic. As affecting the more affluent classes of society; the indulgence over-night of acid wines, punch, or stimulating food and condiments, at supper-parties or convivial meetings, may be followed next morning by an attack of spasmodic stricture, especially in persons of a gouty diathesis. The restraints of society with regard to the retention of urine, the outdoor amusements of hunting, steeple-chasing, or other rough riding across country, are also circumstances under which spasmodic stricture is liable to occur. Or the picture may be reversed; the combined effects of cold and exhaustion drives many a homeless wanderer to seek relief at an Hospital during the early hours of our winter mornings. The anxiety

and harass of business, the pressure of over study, or of writing against time in newspaper offices, &c., may subject the commercial and the literary classes of society to the penalty of an attack of urethral spasm.

*Treatment.*—The cause of spasm must be sought, and if possible removed. In an attack of spasmodic stricture, remedial measures must be directed to the relaxation of the muscular contraction. The most effectual antispasmodics are a warm bath, and a full dose of opium,—the tincture or Battley's sedative. I have used a drachm or more of the compound tincture of camphor with advantage. Chloroform inhaled, has sometimes afforded instant relief. Suppositories have not had much effect. This antispasmodic treatment is most successful when the stricture arises from exposure to cold. But, if the gouty diathesis prevails, or the circumstances of origin point to acidity of urine; then, alkalies and other appropriate remedies must be combined. Catheterism should be avoided as long as possible, the introduction of an instrument tending to provoke spasm; and when resorted to, the catheter used should be full-sized or at least one of the higher numbers.

**INFLAMMATORY STRICTURE.**—An inflamed or congested state of the urethral mucous membrane may occasion a species of temporary stricture. It is less an independent condition, than engrafted on a pre-existing organic stricture, or coincident with spasm.

The *symptoms* are somewhat peculiar. In addition to obstructed micturition, the penis is turgid and erectile, and the urethra bleeds freely on the introduction of even a moderate-sized catheter; there is intense scalding in passing urine, and the stream narrows rapidly during the act, ceasing abruptly before the bladder is emptied. The urine is, as it were, shot out at short intervals from the bladder, itself in an irritable state. Perineal heat, fulness, and tenderness, are complained of, when the inflammation extends far back. In all these respects, inflammatory stricture contrasts with that produced by spasm.

*Causes.*—Retrocedent gonorrhœa, or suppression of the discharge by exposure to cold or wet, or by an inconsiderate recourse to injections during the inflammatory stage. Indulgence in alcoholic liquors or a stimulating diet, will also contribute to the inflammatory or congested state of the urethra.

*Treatment* must be conducted on ordinary principles. This urethral condition resulting usually from suppressed gonorrhœa, it will subside on the reappearance of the discharge. Wrapping the penis in a poultice is a simple remedy which I have often found successful.

**TUMOURS IN THE URETHRA.**—Growths within the urethra, formerly known as “caruncles” or “carnosities” and supposed to be common, are extremely rare. Their nature, according to Sir H. Thompson's careful examination of recorded cases, seems to be of three kinds:—vascular granulations; polypoid formations peculiar to the prostatic part of the urethra; masses of tubercular and cancerous origin. Both the latter forms of deposit are rarely primary in the urethra, but secondary to disease of the kidney, bladder, or prostate; and they seldom appear until the primary disease is far advanced.

The local importance of any such urethral tumour is the degree of obstruction thus offered to the free passage of urine, as a cause of retention.

*Treatment.*—Urethral growths may be removed on the same principles as similar tumours in other parts;—by Excision, Ligature, Caustics, or

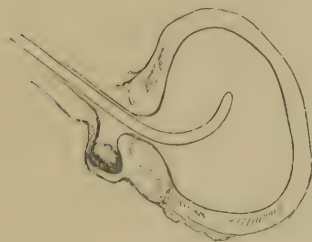


the Actual Caution. Excision can generally be accomplished by means of fine scissors, aided by dilatation of the urethra. In this way I have succeeded, especially as regards the female urethra, in removing vascular and erectile growths, which although not of large size were very troublesome. Ligature is difficult, painful, and tedious. Caustic applications, as nitric acid or potash, can scarcely be restricted in their action to the growth alone; and the actual cautery by means of the galvanic wire will be preferable.

**CALCULUS IN THE URETHRA.**—Urethral calculus is generally derived from the kidney and bladder, or from a fragment of stone becoming arrested in some part of the canal; but rarely, the calculus forms within the urethra, by deposit in the sacculus or dilatation behind a stricture. Here urine constantly collecting may give rise to concretion, or it forms around a particle of calculous matter as a nucleus.

The calculus is usually of the lithic acid variety; it more than occupies the calibre of the canal transversely, and assumes an elongated form; it may attain to a very large size. Several calculi are sometimes present; small, smooth, and faceted.

FIG. 458.



The *symptoms* are obvious; frequent and difficult micturition, bordering on retention; and the stone may be felt externally in the perineum or detected by introducing a sound, which may at once strike against the calculus, or grate roughly over it when imbedded in a dilated portion of the urethra. (Fig. 458.)

Rectal exploration with the finger is often serviceable. Care must be taken, in either case, to guard the canal on the vesical side, with the finger, lest the stone be pushed back or it might slip back into the bladder. Pain in the situation of the calculus is sometimes experienced, and especially if the stone be rough, and moveable in the act of micturition; but not unfrequently there is no such symptom, and the calculus is singularly quiescent and unsuspected.

Ulceration and abscess are liable to ensue, resulting in extravasation of urine, and urinary fistula.

**Treatment.**—Expulsion of the calculus may occur in the passage of a full stream of urine. Hence, the Surgeon sometimes avails himself of this natural mode of cure, by directing the patient to retain his water as long as possible, and then to compress the urethra with his finger in front of the calculus when he endeavours to micturate; the stream of urine coming out suddenly with a forcible gush, carries before it the stone. The removal of an urethral calculus must, however, generally be effected either by extraction or by incision. When situated in *front* of the scrotum, the calculus can often be extracted; by passing down the urethra a long, slender, urethral forceps (Fig. 459), aided by moderate dilatation; or failing thus to remove the stone, it should be pushed back into the

FIG. 459.



perineum, and thence removed by incision, any incision of the urethra in front of the scrotum generally resulting in a fistulous opening. A stone lodged in the navicular fossa near the meatus, may perhaps, be eased out by a slight incision of the orifice with a probe-pointed bistoury.

When the calculus is situated in the *perineal* portion of the urethra, or has been pushed back to that part; it should be removed by a clean median incision,—external urethrotomy, at the same time compressing the urethra firmly with the finger behind the stone, lest it accidentally recede into the bladder. If this happens, a long pair of slender forceps may be introduced and the stone extracted.

After the perineal incision, there is little risk of urinary extravasation, and less of fistula or of stricture resulting.

**RETENTION OF URINE.**—This term is understood to signify an inability, arising from various causes, to pass any urine, or only a very small quantity. It thus differs from the partial retention of urine in engorgement of the bladder with occasional overflow, and which is dependent on enlargement of the prostate. Moreover, the one is a recent or acute condition, the other an habitual or chronic condition.

The *symptoms* are not only an absence of micturition, or the escape of urine by drops after much straining and painful effort; but also, as the bladder becomes distended and rises above the pubes, there is dulness on percussion over that region, extending upwards at length perhaps to the umbilicus. This is accompanied with much distress and constitutional disturbance.

*Causes.*—Various causes may give rise to retention of urine, but they are all reducible to two classes:—that of *defective expulsive power*, in *paralysis* involving the abdominal muscles and bladder; and that of *obstruction* to the passage of urine; as dependent on *prostatic enlargement* from any cause,—inflammation, chronic hypertrophy, or tumour, of a sufficient size to block up the internal meatus of the urethra; *perineal abscess*, occasionally; *stricture of the urethra*, organic, spasmodic or inflammatory; *urethral tumours*, *calculi*, or other foreign bodies in the urethra, occasionally.

*Consequences.*—Unrelieved retention of urine leads generally to *rupture of the urethra*, and especially when the source of obstruction is in the urethra, the canal yielding behind that point, and this event being followed by extravasation of urine; rarely, *rupture of the bladder* occurs in consequence of retention.

*Treatment.*—Retention of urine must of course be regarded with reference to the removal of its cause; but the bladder admits of being entered, and the accumulated urine drawn off, in five different ways:—(1) by catheterism; (2) incision of the urethra through, or behind, the obstruction, usually in the perineum; (3) puncture of the bladder,—through the rectum, (4) above the pubes, or (5) through the symphysis pubis.

*Catheterism.*—This mode of gaining admission to the bladder will usually succeed; in conjunction with the appropriate treatment for any temporary spasmodic or inflammatory obstruction, which may have become engrafted on an organic stricture, from some excess or from exposure to wet and cold,—the circumstances under which retention generally arises. Accordingly, a small-sized catheter is selected, about number 4 or smaller, silver or gum-elastic; and the instrument introduced with due attention to gentleness, caution and patience. The stricture may often yield more readily than might have been anticipated when retention is present, owing

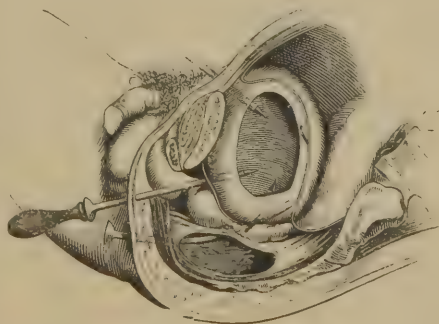
to the dilatation effected by the pressure of urine above; or on withdrawing the instrument from just the entrance of the stricture, the urine will often follow in a full stream. If the Surgeon fails in thus affording relief by catheterism; he should have recourse to relaxatives or local blood-letting, as the case may be. With spasmodic stricture; the patient should be placed in a warm hip bath, and opium given by the mouth, or in the form of enema or suppository, or chloroform administered; the latter agent being of great value in overcoming both voluntary and involuntary muscular resistance. With an inflammatory or congestive state of the urethral passage, as evinced by a turgid penis and tender perineum; local blood-letting from the latter region, by cupping or a dozen leeches, will often effectually subdue this occasion of resistance. After either kind of auxiliary treatment, the introduction of a catheter can generally be accomplished. Recourse to auxiliary measures may be deemed advisable *before* attempting to pass an instrument, and certainly this would be better than any risk of injuring the urethra by rough manipulation.

*Forcible catheterism*, or forcing the stricture as it is termed, will rarely be justifiable; and never in the sense of thrusting a catheter anyhow into the bladder. The forcible dilatation or rupture of an old indurated stricture, as by Holt's operation, is an occasional resource for the relief of retention.

*Incision of the urethra through, or behind, the stricture.*—The first named point of incision, through the stricture, is in fact perineal section; and the second may be performed in a precisely similar manner. The one has the advantage of relieving the stricture as well as the retention; the other leaves the stricture untouched, and it is performed without a guide in the urethra, by carefully deepened incisions so as to hit the passage; the finger having been introduced into the rectum to indicate the point in front of the prostate,—the membranous urethra. This procedure was recommended by Guthrie and Liston, though it has now generally given place to puncture of the bladder per rectum. Both these urethral modes of entering the bladder have the advantage of not directly opening the bladder; and, in relieving retention, they also release any extravasated urine, or matter which may have formed in the perineum.

*Puncture of the Bladder through the Rectum.*—Having emptied the bowel by an enema, the patient is brought to the edge of the bed and his legs held apart as for lithotomy. The Surgeon then introduces the left fore-finger, oiled, into the rectum, and feels for the posterior margin of the prostate; just beyond which point, fluctuation should be perceptible, especially on tapping the hypogastric region with the other hand. The long curved trocar and canula is then passed along the concavity of the finger, as a guide, to the same point, in the middle line

FIG. 460.





and pushed upwards into the bladder; transfixing the rectum and base of the bladder, in the *trigone* of the latter organ where it is uncovered by peritoneum. (Fig. 460.) This space is free from adjoining parts; the prostate in front, the reflection of the peritoneum behind, and the vesiculæ seminales are on each side. The trocar is now withdrawn, the bladder emptied, and the canula retained by means of a waist-bandage and tapes. In performing this simple operation, two additional practical points are worthy of notice; in passing the instrument along the finger, let the point of the trocar be withdrawn into the canula, to avoid wounding the bowel; and leave the canula in, but only just within the bladder, to prevent any irritation of the mucous membrane by the edged-end of this tube. It is allowed to remain for a few days, until urine flows by the natural channel, or until stricture of the urethra or other obstruction has been overcome.

The value of puncture by the rectum has been variously estimated. Mr. Cock, who has performed this operation in a large number of cases, is led to very favourable conclusions respecting it; that it is more easy of performance, and less dangerous in its results, than any mode of entering the bladder for the relief of retention. The objections made to the operation are—not so much the liability of perforating the peritoneum or seminal vesicles, both of which parts may with care in performing the operation be avoided—but the liability to urinary infiltration, pelvic inflammation and abscess between the rectum and bladder, and a persistent fistulous opening. In one singular case that Mr. Erichsen relates, rectal flatus became diffused through the cellular tissue of the pelvis and down the thighs and nates; an emphysematous condition from which the patient died.

Puncture through the rectum seems to be appropriate only when; with retention from stricture, there is no sign of abscess or extravasation in the perineum, the urethra is apparently not dilated behind the stricture, the prostate not much enlarged; and a catheter cannot be passed under chloroform, and with care and patience. These circumstances will considerably restrict the cases for having recourse to this operation.

*Puncture of the Bladder above the Pubes* is easily performed. A vertical incision in the middle line and just above the symphysis pubis, is made to the extent of about two inches, and carried down through the linea alba, so as just to admit the tip of the finger to reach the distended bladder. An assistant steadies this organ by even pressure with his hands against the abdominal wall, on either side; and a slightly curved trocar is entered downwards into the bladder (see Fig. 460), the urine drawn off, and the canula allowed to remain for a few days as may be necessary. It is secured by tapes and a T bandage.

This operation has been often practised, and strongly advocated by Mr. Paget of Leicester, and by some other Surgeons of eminence. But it is not generally resorted to. The objections are, some risk of urinary infiltration, or of a fistulous opening remaining. But there may be no alternative between supra-pubic puncture—and rectal puncture, or even the perineal section; when, with impassable stricture, the prostate is considerably enlarged. Rectal-puncture may be absolutely impracticable, from the impossibility of reaching with the finger behind the enlarged prostate.

*Puncture of the Bladder through the Symphysis Pubis.*—An ordinary hydrocele trocar of medium size is introduced, with or without a small

preliminary incision, about the centre of the symphysis from above downwards, and in a direction at about right angles to the vertical axis of the body. It is thrust onwards, somewhat obliquely downwards and backwards towards the sacrum, this direction being varied according to circumstances; a piece of flexible catheter is then passed through the canula and retained by a tape. Dr. J. M. Brander of Jersey, in 1825, first proposed this operation; and several successful cases have since occurred in his practice, and in the hands of other Surgeons.

**EXTRAVASATION OF URINE.**—This may take place from unrelieved retention of urine; and generally, the urethra is ruptured behind the seat of obstruction, the bladder very rarely.

*Rupture of the Urethra* occurring behind the seat of stricture, the point of rupture is almost invariably the membranous portion of the urethra and just in front of the triangular ligament. Here, the urethra being naturally weak, it is also dilated in the form of a sacculus or pouch, by the constant distending pressure of the urine, resisted by the strictured passage in front. Under this pressure, the weak and dilated urethra tends to yield; but the immediate cause of extravasation seems to be ulceration of the mucous membrane, either from urinary irritation, or as the result of an abscess forming close to this part of the urethra, externally, and which induces ulceration into the canal. The urine escaping from the urethra, or becoming extravasated, into the adjoining cellular tissue, gradually infiltrates this texture beneath the deep layer of the superficial fascia in the perineum; and the fluid following the boundaries of this fascia, it forms a bag, limited by the base of the triangular ligament below, and the rami of the pubes laterally; thence continuing upwards, the scrotum and penis become infiltrated, then the lower part of the abdomen and outwards to the line of Poupart's ligament; but there is no extension downwards on the thighs.

The *symptoms* of extravasation are remarkable:—the characteristically bounded swelling, and its increasing size, and extent; the scrotum and penis especially becoming enormously distended, the one perhaps to the size of a large cocoa-nut, the other to that of a Bologna sausage; gangrenous inflammation of the cellular texture soon occurs; the skin assumes a dusky red hue, purplish or black gangrenous spots appear, and frequently one such patch is seen on the dorsum of the penis. Ultimately sloughing of the skin and cellular texture of the scrotum, exposes the testicles bare and pendulous. The constitutional disturbance is that of low typhoidal depression; a rapid feeble pulse, dry brown or black tongue, and muttering delirium as death approaches.

*Treatment.*—The primary indication of treatment is to give an immediate, free and dependent outlet to the extravasated urine, with the fetid purulent fluid and sloughs of cellular texture which soon form. This indication, is, therefore, both preventive and remedial. Hence an incision or two should be made in the scrotum on either side of the middle line; exposing the cellular texture, and extending from the front to the back of the bag. Another incision may be made on the dorsum of the penis, and perhaps another over the pubes. A quantity of strong-smelling or ammoniacal urine trickles out, and continues to ooze for hours or days; at the same time, the peculiar appearance of the cellular texture,—its pearly-white colour and tension, or its opaque, sodden, and matted appearance, indicates the degree of urinary infiltration, or the supervention of sloughing. Tension having been thus relieved, a catheter can often be passed

through the stricture into the bladder. This should be done at once, and the instrument retained in the usual manner by means of a waist-band and tapes. The catheter is left *unplugged*, that the urine may drain away from the bladder, and as the instrument occupies the *calibre* of the urethral canal, both these provisions will prevent any further extravasation. By this arrangement also, the ruptured urethra heals over the instrument. A large poultice or warm fomentation, or an antiseptic application, is placed around the scrotum and over the whole extent of the extravasation. The relief afforded by the incisions is almost instantaneous, the patient often soon rallying from the previous state of nervous prostration and low fever. Stimulants, in the form of wine or brandy, with supporting nutriment, may now be given advantageously; and bark with chlorate of potash, or ammonia, will prove very beneficial. Opium also is a most valuable agent; in the early period to counteract the nervous excitement which not unfrequently accompanies prostration, and afterwards when excitement sometimes prevails, to subdue it.

The subsequent treatment of sloughing and granulation,—after a long and trying process of exhaustion and repair, must be conducted on ordinary principles.

*Rupture of the Bladder*—occurring as a very rare consequence of retention—is attended with extravasation of urine into the peritoneal cavity; or more commonly, below the line of the peritoneal reflection, into the pelvic cellular texture, whence it may secondarily get into the peritoneum by ulceration.

The *symptoms* are, sudden and acute abdominal pain, the patient usually feeling that something has given way; and there is overwhelming collapse. Dulness on percussion over the region of the bladder is now substituted by general abdominal fluctuation and distension, with total incapability to strain out a drop of urine. Maniacal delirium sometimes supervenes. Death ensues in a period varying from thirty-six hours to four or five days.

The indication of *treatment* would seem to be that, an outlet should be given to the urine by puncture of the abdomen. But no such cases are recorded; and any treatment has hitherto had no effect in averting the inevitably fatal issue.

**URINARY ABSCESS.**—Suppuration circumscribed by plastic matter, forming an abscess, is liable to occur close to the urethra in some part of its extent. It may arise from any source of urethral irritation; usually the collection of urine in the dilatation behind a stricture, or from urethritis, or simply from the irritation of the passage of instruments. The suppuration is apparently induced either by ulceration of the mucous membrane, allowing of slight urinary extravasation into the sub-urethral cellular texture, and which thus becomes a direct source of irritation; or, abscess may perhaps result from the influence merely of the irritation in the adjoining portion of the urethral canal. In the one condition, abscess, proceeding from the canal, may open externally; in the other condition, abscess forming outside the canal, may open into it, and externally. Urinary abscess is liable to form in various situations, in relation to the urethral tract; and it is thence designated, *perineal*, *scrotal*, *intra-pelvic*, and *ante-scrotal* or *penile*. This also represents the order of frequency in the situations of such abscess.

*Symptoms.*—A small, circumscribed, hard, and painful tumour is felt, in the neighbourhood of the urethra; which scarcely attains any consi-



derable size, unless in the perineum. It is not attended by much constitutional disturbance.

*Treatment.*—Early incision is absolutely necessary, to prevent further extravasation of urine, or the establishment of urinary fistula. A free, and often deep incision, in the middle line, will give instant relief to tension or afford exit to matter. The part should then be well poulticed.

URINARY FISTULÆ commonly result from urinary abscess, communicating with the urethra, and externally. The internal opening is usually in the membranous urethra,—just behind the common seat of stricture; the external opening is commonly perineal or scrotal; and the intervening parts are traversed by the fistulous passage, or passages in various and often devious routes. Sometimes, the fistula is ante-scrotal or penile; and here the communication with the internal or urethral opening is almost direct. Less frequently, the openings of urinary fistulæ are found in the groins, the upper part of the thighs, the adjacent part of the nates, or even above the pubic symphysis. In size, the fistulous passages differ considerably; some admitting only the finest probe, others readily the finger. In point of number also, they vary remarkably; penile fistulæ being usually single, whereas, scrotal and especially perineal fistulæ are often numerous. Fifty-two openings, Civiale found in one such case. The surrounding structures differ so much in their condition as almost to warrant the distinction of urinary fistulæ into two classes; the *simple* or healthy fistula, and the *indurated* fistula. In the latter condition, the fistulæ are sometimes connected with cavities secreting pus, and detaining in their interior some quantity of the urinary secretion. The surrounding parts share the induration; the scrotum and penis becoming enormously enlarged and brawny or almost cartilaginous. Another and more important distinction, which characterizes a class of urinary fistulæ, is that wherein the urethral opening results from actual *destruction* and *loss of substance*, by sloughing; in consequence of urinary extravasation, phagedænic ulceration, or mechanical injury. A portion of the floor of the urethra having been destroyed, and the tissues intervening between it and the external surface; the urethral mucous membrane of the upper aspect or roof of the canal, becomes visible from the outer orifice of the fistula. Such apertures may be found in similar situations to those of abscess-fistulæ; as perineal, scrotal, and ante-scrotal or penile fistulæ.

The *symptoms* of urinary fistula, having reference to the act of micturition, are characteristic of the existence of such fistula; and are tolerably distinctive as to its situation, size, and mode of origin.

In all urinary fistulæ, the urine escapes partly, at least, by the fistulous opening, or openings; in the latter condition, the urine spurting out perhaps as if it were issuing from the rose of a water-pot. This may be often seen in perineal and scrotal fistulæ, where numerous openings frequently co-exist. The situation of the internal opening is less correctly indicated, owing to the devious routes of the fistulous passages. But the seat of stricture will supply this information. According to the size of the fistulous communication, more or less urine will escape through the unnatural passages; and proportionately, less or more by the urethra. And the mode of micturition in this respect is tolerably diagnostic of fistula which results from destruction of a portion of the urethral canal; the whole or nearly the whole of the urine then passing by the artificial channel in a full stream.

*Treatment.*—When a stricture, followed by abscess, is the cause of the

fistula; the primary indication of treatment will be the removal of that condition. This may be done in the usual manner; by dilatation, internal urethrotomy occasionally, external urethrotomy more commonly,—and usually the perineal section, owing to the situation of the stricture. Having thus succeeded in enabling the urine to flow by the natural channel; the fistulous passages are set at rest, and they not unfrequently contract and close. Thus, both simple, and even indurated, urinary fistulæ, may be cured.

But old, *indurated* fistulæ, are indisposed to heal, although the original cause has been thus removed. Recourse must be had to additional treatment for this purpose. The measures remedial in chronic fistulæ generally, are here also appropriate, and may have to be tried in succession. They are chiefly; stimulating applications to the fistulous tract; compression; and incision along the course of the fistula to induce healing from the bottom. Of *stimulating applications*, various agents have been employed; in the form of injection by means of a fine syringe, as tincture of cantharides, solutions of nitrate of silver, sulphate of copper or of zinc. A probe coated with fused nitrate of silver, may be passed along the tract occasionally, and this will often succeed in causing contraction. The actual cautery is sometimes curative applied in the form of a red-hot wire, or the galvanic-wire cautery, which can be conveniently introduced along the tract before being heated by the current. *Compression*, by means of an india-rubber air-pad, applied to the perineum, has proved successful in some cases of perineal fistulæ. *Division* of the fistulæ along their course nearly to their origin in the urethra, can be accomplished as usual, with a grooved director and narrow blunt-pointed bistoury. Several passages may be thus thrown into one, and strips of lint should then be inserted to provoke granulation from the bottom of the tract.

During recourse to these measures for the cure of urinary fistulæ, any passage of urine along their course, must be prevented, by regularly using the catheter three or four times a day. The patient may be instructed how to do this for himself, at every call of nature.

Respecting the eligibility of these modes of treatment; in long, narrow, and tortuous fistulæ,—stimulation and compression seem to be the most appropriate; when the fistulæ are large and numerous, incision is more suitable,—the perineum and scrotum being sometimes quite riddled in all directions.

Larger-sized urethral openings, in consequence of actual *destruction* of some portion of the wall of the canal, require operative interference of a plastic character, to repair the loss of substance.

*Urethro-plastic operations* are designed to effect reparation in one of two ways; either by simple closure of the fistulous aperture, or by borrowing the surrounding integument to accomplish this object. These procedures are severally applicable according to the part of the canal where the opening exists.

Perineal fistula may admit of closure by simply paring the edges down to the urethra, and uniting them with quilled sutures, or by Boze-man's buttons.

Ante-scrotal or penile fistula is much more difficult to close, owing to the want of substance in the coverings of the urethra at this part of its extent, and the liability of the part to disturbance by erection of the organ or other motion. When the opening is *small*, Dieffenbach's mode of closing it may be applicable. It consists in first stimulating the edges,

by frequently touching the surrounding skin with the strong tincture of cantharides, the day before the operation; and then using the "lace suture." A sound is introduced into the urethra beyond the opening; the operator takes a small curved needle, sharp at the point but not at its sides, armed with a stout silk waxed thread, and by means of a needle-holder introduces it beneath the skin at about three lines from the border of the fistula. The needle is carried deeply, but not into the urethra, and made to emerge at another point; then dipped again, and so on by three or four stitches, carried round the opening, until it emerges at the point of entrance. The thread, thus embedded in the cellular texture around the fistula, is drawn by its two ends together, so as to close the opening; and then fastened by a knot. In three or four days, the ligature may be divided and drawn away. A *larger-sized* aperture will probably require some substitution of the surrounding skin; and this may be accomplished by Nélaton's operation, as follows:—The edges of the fistula having been pared, the skin around to the extent of about one inch must be dissected by passing a small narrow-bladed knife subcutaneously around the aperture; thus producing a detached area of integument, which is brought together over the opening and the edges united by a few points of fine suture. This procedure may sometimes be advantageously modified by making lateral incisions, and then passing across underneath the flap a slip of india-rubber, to prevent contact of the urine which would disturb the process of adhesion in the line of closure over the urethral opening.

During the course of reparation by any of these urethro-plastic operations, the urine must always be drawn off by a catheter, three or four times daily.

URINARY VAGINAL, AND UTERINE FISTULÆ.—Fistulous openings may be established; (1) between the urethra and vagina; (2) between the bladder and vagina; or (3) between the bladder and uterus. These communications result; from contusions or lacerations in parturition, the introduction of foreign bodies, the effects of calculous concretions in the bladder, or operations for their removal. Openings caused by the extension of cancerous ulceration are here omitted, as such fistulæ are quite incurable.

Much, and persevering attention has been given of late years to the Surgical treatment of the various forms of simple fistulæ; and results have been obtained in a large number of cases, sufficient to establish the operative cure of these distressing conditions as a finished achievement. We are chiefly indebted for this addition to Surgery, to the labours of Dieffenbach, Dr. Bozeman, Mr. Baker Brown, Dr. Marion Sims, Professor Simpson, Mr. Bryant, and Mr. Spencer Wells.

The principal features connected with the operations as more recently practised, and which have led to their increasing success, are thus enumerated by Mr. Jonathan Hutchinson. Speaking chiefly of vesical fistulæ; 1st the use of chloroform, which facilitates the difficult step of the dissection; 2nd the use of metal sutures instead of silk; 3rd the avoidance of the vesical mucous membrane, both in the dissection, and in the application of the sutures; and 4th increased attention to keeping the bladder empty afterwards. It may be added, that metallic or wire shields, adjusted over the line of union, were much relied on a few years since; but they are now generally discarded in favour of sutures alone.

*Vesico-vaginal fistula*, may be taken as the type of the three urinary fistulæ, relating to the vagina and uterus. The requisite operation con-



sists, in completely paring the edges of the vaginal aspect of the fistula, and then uniting them by suture. But many particulars should be observed, as tending materially to the success of this procedure; and they are tersely stated in the following summary by Hutchinson, which I can endorse by my own experience:—The instruments used are small tenotomy-like knives, forceps, needles, and fine silver-wire. Instruments for carrying the wire have also been devised; as Startin's tubular needle. The patient should be in her best state of health, and the bowels have been well cleared out. Chloroform having been given, the woman is placed either on her side with the knees well drawn up, or in the usual lithotomy position. The parts being thoroughly exposed by a duck-bill speculum, and the nates being held widely apart by an assistant; the operator proceeds to drag the opening as low down as possible, with a view to facilitate the paring of the edges. This may be accomplished either by hooks, blunt or sharp; by means of a metal suture; or by the introduction of a flexible sound through the urethra, which is brought out again through the fistula, and then bent backwards. This latter plan furnishes the Surgeon with a most efficient hook, and one which cannot easily slip. In paring the edges, it is necessary thoroughly to denude every part; for if the smallest portion of mucous membrane be left, it may prevent union. None of the mucous membrane of the bladder must be removed. The wound should present a bevelled oblique line, slanting from a large vaginal opening to a smaller vesical one. The denudation being complete and free, sutures are next to be introduced. These should be passed obliquely from at least a third of an inch outside the edge of the incision. They must not include the mucous membrane of the bladder. The tightening and tying of wire sutures is easily accomplished by the fingers. Care must be taken not to pull them too tight, so as to invert the edge of the vaginal mucous membrane.

*After-treatment* is simple:—The small double-curved silver catheter, invented by Dr. Sims, or an ordinary gum-elastic one, should be passed and retained unplugged; that the urine shall constantly drain out of the bladder. This should be constantly watched; and the instrument cleansed and then re-introduced twice a day. The patient must lie on her side with the knees drawn up; and her general health be well sustained. It is of the utmost consequence to prevent the action of the bowels for at least a week; and this may be accomplished by administering a full dose of opium soon after the operation, and maintaining its influence subsequently by smaller doses. Dr. Sims lays much stress on this point, as an element of success. The removal of the sutures prematurely is a greater evil than their unnecessary continuance; they should certainly not be withdrawn before the ninth or tenth day, and then with great caution.

*Urethro-vaginal fistula* is more easily closed by a similar procedure; but union takes place less readily, owing to the unavoidable pressure of the catheter on the line of union.

*Vesico-Uterine fistula*, is that condition wherein the fistulous communication exists between the bladder and cervix uteri. Certain modifications in the plan of operation will be required. It might become desirable to obliterate the upper part of the vagina, in order to connect the uterus with the bladder; thus allowing the menstrual fluid to pass through this organ, but preventing incontinence of urine.

These operative procedures may have to be repeated a second, or third time, and even several times, in the same case; partial closure only being

effected in the first instance, and afterwards more and more completely. Such temporary failure, however, will not weary the perseverance of the true Surgeon, nor the endurance of the patient,—who is too glad to get rid even by degrees, of a most troublesome, offensive, and socially distressing urinary leakage. But, it not unfrequently happens that a pin-hole opening, only, remains, defying any plastic procedure. In common with many other Surgeons, I have had to contend with this difficult residue of the operation. No means of closing the aperture will, I believe, prove effectual except the introduction of a red-hot wire, or better,—the galvanic-wire cautery.

## CHAPTER LXI.

### INJURIES AND DISEASES OF THE PENIS.

THIS organ is liable to Injuries and Diseases in common with other parts of the body, presenting, however, peculiar features of importance; and to certain Malformations or Congenital Defects which are necessarily peculiar to it.

*INJURIES.*—*Wounds*, and *Laceration*, of the Penis, present two important characters; copious hæmorrhage, and possibly, implication of the urethra. These lesions may be produced by instruments,—whether sharp-cutting, penetrating or lacerating, or by external violence, as gunshot injury; and they may be accidental, or sometimes vindictively inflicted, or even self-inflicted. But, the tendency to reparation is remarkable, especially in the integumental portion of the organ.

*Hæmorrhage.*—The erectile structure of the penis is not unfrequently the source of hæmorrhage; the blood issuing either from the corpora cavernosa, the corpus spongiosum, or from both; and in the form of a free, persistent dripping or oozing. The dorsal artery, or the artery of the corpus cavernosum, may, however, be the source; the blood issuing in the usual manner, as a jetting arterial stream. In extensive wounds of the penis, the blood proceeds both from the erectile structures and from the arterial trunks.

The *treatment* will vary accordingly. Oozing hæmorrhage may be arrested by cold or astringent applications, and pressure. A large catheter should be passed into the bladder, as a means of counter-support, and compression effected by a finger-bandage or circular strips of adhesive plaster. Compression with a pad of lint, thus retained, is sometimes sufficient, without the resistance afforded by a catheter. Arterial hæmorrhage must be managed by ligature; or perhaps torsion, when the vessel is free and can be well twisted with the forceps.

*Wound of the Urethra.*—This lesion may occur as part of a penile wound, or independently,—the urethra alone being cut or penetrated. And the wound may be partial or complete division of the urethra.

The *signs* are; the escape of blood from the meatus, or in micturition,—bloody urine and escape of urine from the urethral wound. In the ante-scrotal portion of the penis, the wound is easily discovered on examination.

*Treatment* consists, in at once passing a gum-elastic catheter through the external meatus into the bladder, and retaining the instrument; the

edges of the wound can then be brought together over the instrument, by fine strips of plaster or a point or two of suture.

*Laceration* of the urethra, is specially apt to occur in connexion with fracture of the pubic rami; or, from external violence; as a kick in the perineum, or a fall astride a girder or the edge of a plank of wood. The membranous urethra is here the seat of injury; and the laceration may be partial or complete,—the urethra being torn partly or entirely across. There is also more or less perineal ecchymosis or bruising.

Certain *signs* are distinctive of laceration. Urethral hæmorrhage or bloody urine occur as from wound; but the effort of micturition is accompanied with a deep burning pain, and symptoms of urinary extravasation, commencing in the perineum, rapidly ensue. If laceration be complete, there is inability to pass urine, and extravasation proceeds with greater rapidity. This condition may terminate in urinary fistula.

*Treatment* is essentially the same as in wound of the urethra. A catheter should be at once passed, to allow of urethral reparation, and, in the case of laceration, to prevent the extravasation of urine which cannot here escape by an external wound. With *complete* laceration of the urethra, it may be very difficult or impossible to pass a catheter. Having, therefore, introduced the instrument as far as it will go; a free incision should be made in the middle line upon the point of the catheter, which can then probably be passed onwards into the bladder. Or at least an outlet is thus provided for the urine. If, with this precaution, retention ensues, puncture of the bladder through the rectum may be justifiably resorted to.

*Extravasation of urine*, or perhaps urinary fistula, as the result of urethral laceration, must be treated as already explained with reference to these conditions.

**DISEASES.**—**BALANITIS.**—Inflammation of the thin mucous membrane of the prepuce and glans penis, is attended with some redness and smarting, and a profuse, thin, opalescent, muco-purulent discharge, with some infiltration of the prepuce bordering on phymosis. Excoriation is apt to occur. When the mucous membrane of the glans is specially affected, the inflammation is known as *Posthitis*. The prepuce is not unfrequently long and redundant, a condition which seems to predispose to Balanitis.

FIG. 461.



This inflammatory affection is usually the result of local irritation; from gonorrhœal discharge frequently, and hence named “external” gonorrhœa, or simply from want of cleanliness; but it also arises in young and delicate boys, from disordered health, and during hot weather.

The *treatment* is chiefly topical; a slightly astringent wash, as lead lotion or lime water, or slight pencilling with nitrate of silver, especially in the groove around the corona glandis. Saline, cooling medicine may also sometimes be given with advantage.

*Chronic Balanitis*—unattended with much redness and smarting—often induces a fleshy, rough or granular thickening of the preputial mucous membrane, and the discharge is still abundant. In this state, the membrane may be dusted with a mixed powder of calomel and



calced magnesia. When conjoined with phymosis, astringent injections must be used beneath the prepuce, which cannot then be uncovered.

**PHYMOSIS.**—By this term is meant a contracted state of the orifice of the prepuce or fore-skin, whereby the glans cannot be uncovered completely, if at all; the orifice being reduced to even a pin-hole opening. (Fig. 461.) This condition of the prepuce may be congenital, or acquired; and these two modes of origin sometimes co-exist.

*Congenital* phymosis, a not uncommon defect, is associated usually with an elongated and redundant state of the preputial skin, so as to project beyond the glans; but the mucous membrane is deficient, and thus prevents retraction. Adhesions sometimes exist between the opposed surfaces of this undeveloped membrane and the glans; and the glans itself is small, owing apparently to the restriction offered by the prepuce to its development.

A source of inconvenience only at first, phymosis gives rise eventually to symptoms of vesical irritability, incontinence, and even to retention of urine; or often to symptoms simulating stone in the bladder. By the accumulation of sebaceous preputial secretion, irritation and inflammation of the part, or balanitis is apt to arise; and in after-life, sexual intercourse is rendered abortive by the contracted prepuce retaining the emitted semen. Impotency might then be suspected. In the event of gonorrhœal or syphilitic infection, the preputial condition more or less conceals the nature of the case, and interferes with the local treatment.

*Acquired* phymosis, is the result of repeated balanitis and thickening of the prepuce, or of chancres with induration, or their cicatrization and contraction,—especially when seated near the orifice of the prepuce.

*Treatment.*—The cause and the degree of phymosis will indicate whether the remedial measures should be operative, or not. In *acquired* phymosis; an acutely inflamed state of the prepuce, or an unhealthy sore, forbids operative interference, lest the wound should become unhealthy. Preputial injections may be used, and when the causative condition has been subdued, the phymosis will probably gradually disappear. Otherwise recourse must be had to operation. But if the contracted prepuce conceals the nature of a sore; or, if this having a destructive character, as a phagedænic or sloughing ulcer, the requisite applications cannot be made; then an operation is at once necessary to expose the sore for its treatment, though not to relieve the phymosis. In *congenital* phymosis, an operation may always be performed, for the sake of convenience and cleanliness; unless the prepuce can be retracted with tolerable facility for either purpose. This, however, is usually the tightest form of phymosis, and where the prepuce is also redundant.

The operations for phymosis are of two kinds; the contracted prepuce may be slit-up, or circumcision may be performed. Both operations are sometimes requisite.

*Slitting-up of the Prepuce.*—A grooved director is introduced between the prepuce and glans, and moved to the front so as to know that it is not in the urethra; a narrow, curved, sharp-pointed bistoury is then passed along the groove and thrust through the prepuce, dividing it as the knife is withdrawn outwards. The mucous membrane and the skin should be severed to an equal extent, but the incision need not be more than half an inch in length, the contraction being at the orifice of the prepuce. Two or three points of suture will be necessary to bring the

mucous membrane and skin together, in each half of the prepuce; and thus promote union by adhesion. If this be not done, the skin and membrane become separated by considerable swelling after the operation, and heal by granulation.—a slower process, and which leaves a thickened margin to either flap of the prepuce. I am accustomed to modify this simple operation to a procedure yet more simple; I divide only the mucous membrane, and retract the prepuce as the knife is withdrawn; thereby unsheathing the glans to the requisite extent for its complete release. A blunt-pointed bistoury, or a concealed knife, may be used; the latter instrument being sufficient for the operation without a director. Of course, no sutures are required.

*Circumcision.*—The prepuce must be drawn well forwards, until that portion which corresponds to the back of the glans is brought in front of it; the projecting prepuce is then seized immediately in front of the glans with a pair of narrow-bladed forceps, and held by an assistant; when the free portion of prepuce,—already placed on the stretch—is severed just in front of the forceps by one stroke of a bistoury. On removing the forceps, the mucous membrane will be seen embracing the glans, and this must be snipped-up with a pair of blunt-pointed scissors, sufficiently to uncover the glans; and the frænum also snipped across if necessary. Any small arteries, on either side, and one or two near the frænum, must be secured by ligature or torsion; although bleeding slightly at the time, these vessels are apt to be the source of profuse hæmorrhage afterwards, even to the amount of three or four pints of blood. A few points of suture,—five or six, should then be inserted to unite the mucous and cutaneous margins around the circular incision.

In congenital phymosis sometimes, adhesions between the prepuce and glans require to be dissected up; or a quantity of white epithelial matter may have accumulated as a cake around the glans, and this must be gently scraped off.

Of the two operations,—slitting, and circumcision, of the prepuce; the latter procedure is more generally applicable, as giving the cleanest result, and it is absolutely necessary when the prepuce is in a diseased state.

FIG. 462.



*PARAPHIMOSIS.*—In this—the opposite condition to phymosis—the prepuce is in a forcibly retracted state behind the corona glandis, whereby the glans cannot be covered. (Fig. 462.) The constricting preputial orifice soon becomes the source of strangulation; resulting in swelling of the prepuce, which encloses and buries the seat of stricture in a deep furrow, with a roll or collar of the swollen prepuce in front and behind; congestion and swelling of the glans are superadded; and

thus the reduction is rendered proportionately difficult or impossible. Most severe pain attends this state, increasing to torture; and ulceration and extensive sloughing are apt to ensue.

Paraphimosis occurs most commonly in boys; or in adults, who having naturally a narrow preputial orifice,—or tendency to phymosis, happen to have allowed the prepuce to remain drawn back for a while. A diseased and indurated state of the prepuce, when retracted, will also

tend to induce constriction; and paraphymosis not unfrequently arises in this way during primary syphilis.

*Treatment.*—*Reduction* should be effected without delay. Any cold or astringent applications are of little avail, the source of constriction and strangulation still remaining. Chloroform may sometimes be administered, as the reduction by manipulative compression is necessarily painful, and of some duration. Then the Surgeon takes the body of the penis between his fore-fingers, just behind the swollen prepuce; he compresses and pushes back the glans with his thumbs, at the same time drawing the prepuce forwards, which slowly rolls over the glans as this disappears. There will still be a tendency to retraction, so that a little continued compression of the whole end of the organ, for a minute or two, may be advisable. In ninety-nine cases out of a hundred, this method of treatment will prove successful.

When reduction cannot be effected by this procedure, after fair trial, the stricture must be *divided*. This is done by separating the two swollen folds of the prepuce to reach the circular constriction, in the furrow between them; and then dividing it with the point of a narrow bistoury on each side of the middle line, thus avoiding the dorsal vessels of the penis. A slight incision, almost a touch with the knife, will be sufficient to enable the prepuce to be drawn forward in the manner just described. It may be requisite to make a few punctures in the swollen preputial folds to evacuate serous fluid, before reduction can be accomplished. And perhaps also, the effusion having become partly consolidated, the prepuce cannot be drawn forwards; although the stricture has been divided. But, in a few days, the swelling subsides by absorption, and then reduction becomes easy. The *period* after paraphymosis when division of the stricture becomes necessary, is, I should say, usually about thirty-six hours; and later than that, the swelling may have to be diminished by the additional aid of puncture, or by absorption.

*Gangrene.*—Inflammation and œdema of the prepuce are very liable to occur, but gangrene seldom, unless in consequence of a chancre having assumed a sloughing character or a state of sloughing phagedæna. Nevertheless, gangrene of the penis has been known to ensue in typhus fever and in paraplegia. A case of spontaneous gangrene occurred in a patient under the care of Mr. Partridge, in King's College Hospital; and I have known a gangrenous patch to form, in a patient whom I attended for orchitis which rapidly proceeded to sloughing.

*Hypertrophy of the Prepuce.*—As the result of chronic inflammation, a solid œdema of the prepuce may subside; but an hypertrophied condition or a kind of elephantoid growth of the prepuce may form, necessitating excision. In one such case, which Vidal relates, the organ had attained to an enormous size; as large as a thigh and reaching to below the knees. Yet this monstrous growth was successfully excised.

*Warts.*—The mucous membrane of the prepuce and glans is liable to be the seat of warty growths, as the result of long continued irritation from gonorrhœal discharge or that of a syphilitic sore. The ichorous matter accumulating under the prepuce gives rise to these growths, especially in the furrow around the corona glandis. Cleanliness is, therefore, the best preventive.

Treatment is removal of the growths; either by snipping them off with curved scissors, or destroying them by dusting the surface with a powder consisting of equal parts of *savine* and copper.

CANCER OF THE PENIS occurs in two forms; Scirrhus, and Epithelial



cancer. The characters of these diseases present nothing peculiar. *Scirrhus* commences as a hard tubercle in the groove under the glans, and thence infiltrates the body of the organ. Its production seems to be predisposed by congenital phymosis. Thus, of 12 patients with this form of cancer, who came under Hey's observation, 9 had congenital phymosis. Conversely, the Jews, who are circumcised, are, Travers states, seldom subject to the disease. *Epithelial Cancer*, is, Prof. or Humphry believes, the only form of cancer of the penis. It commences usually on the glans, as a firm, warty elevation, having a broad base. At first painless, and covered with a cuticular crust; this being shed or rubbed off, the growth becomes painful, bleeds a little, and soon ulcerates, discharging a thin, fetid sanguineous fluid. It spreads, destroying the glans, opening the urethra, and involving the prepuce. The inguinal glands become affected, but not distant organs. Occasionally, the prepuce is the seat of this form of cancer. Phymosis here also seems to be a predisposing condition; and the prepuce may be ulcerated through, disclosing the cancerous growth.

*Diagnosis.*—In the early stage of cancer, there may be some difficulty in distinguishing between a cancerous wart, and a common wart, or chancreous induration which has not ulcerated or has cicatrized. But the ulcerative tendency of cancer, and the character of the discharge, with the slow steady progress of the disease; are diagnostic. The somewhat advanced period of life, and the negative effect of treatment, will also corroborate the nature of the disease.

*Treatment.*—The only treatment is extirpation; either by circumcision, or by amputation of the organ.

*Circumcision* is appropriate only when the disease is strictly limited to the prepuce; a comparatively rare condition, whether as regards the origin of cancer of the penis, or the stage when this affection usually comes under surgical treatment.

*Amputation of the Penis.*—This is a very simple operation, yet certain particulars must be observed to ensure its satisfactory performance. Amputation may be effected by the knife, or the *écraseur*; the former instrument being generally preferable. The operation should always be performed near the root of the penis, in order to completely remove the disease. An assistant holds that part of the organ firmly between the thumb and finger, to prevent the liability of its slipping back under the pubes; and the Surgeon laying hold of the penis draws the integument slightly forward, and then severs the body of the organ near its root by one sweep of the knife from above downwards. If too much integument be drawn over the stump, it may overlay the urethral orifice; if too little, an inconvenient puckering ensues. Bleeding vessels are then to be secured; usually, five arteries require ligature,—the two dorsal arteries, the artery of the corpus cavernosum on each side, and one in the septum. The oozing surface of the corpora cavernosa will spontaneously cease to bleed, or hæmorrhage thence proceeding may be restrained by a compress, secured by a T bandage. Granulation and cicatrization close the wound, the skin becoming puckered around the urethral orifice. During and after this process of healing, this orifice has a tendency to contract, resulting in stricture of a most troublesome or even fatal character. To prevent any such result, a catheter should be introduced and kept in the bladder; the silver female catheter, or a gum-elastic one, may be used now that the urethral passage is so much shortened. When an instru-

ment is not easily borne, Mr. Teale's little addition to the operation will be convenient; a catheter is introduced, and the urethra and adjoining skin are slit up with a bistoury to the extent of about two-thirds of an inch. A single suture is then placed on each side of the slit, uniting the skin and mucous membrane. Perfect patency is thus given to the orifice, which has a long, oval form; and after cicatrization has finished, there remains a free opening into the urethral canal, and no mechanical aid will be required. This procedure is applicable also when contraction has occurred from cicatrization after amputation; thereby sparing much trouble and pain in endeavouring to effect dilatation. I have accomplished the same result, by simply inclining the bistoury forwards, in performing the amputation; so as to make an oblique, oval aperture of the urethral termination.

After amputation of the penis, the stream of urine is projected downwards between the legs; and this inconvenience may be avoided, as Paré suggested, by wearing a short funnel, adapted to the pubes over the stump, whereby the urine is carried away from the person.

The results of amputation of this organ for cancer, have been tolerably successful; especially as regards the epithelial form of the disease. In several instances, no recurrence has taken place, even for years; six, eight, ten, or twenty. Recurrence may, however, ensue; either in the stump, or in the inguinal glands. The latter may admit of extirpation.

Tumours, of a non-malignant nature, occasionally form in the penis. Thus, *fibro-plastic* growth in the prepuce has been known to occur, invading the corpus cavernosum; and *naevus* under the prepuce.

MALFORMATIONS.—(1) Deficiency of a portion of the urethra, laying open the canal from the external meatus, is a not uncommon malformation. It is a congenital condition by arrest of development.

*Hypospadias*, the most frequent form, is that condition wherein the under part or floor of the urethra is wanting; to the extent usually of the glans, or occasionally as far back as the root of the penis. Through the under fissure thus presented, the urine is passed somewhat inconveniently, and the semen is ejected in an unsatisfactory manner during sexual intercourse. When the fissure extends some way back, it may be impracticable to eject the semen into the vagina.

*Epispadias* signifies the opposite condition; that wherein the upper part or roof of the urethra is wanting, to a variable extent from the meatus, together with a corresponding portion of the glans and of the mesial junction of the corpora cavernosa. (Fig. 463.) This upper-fissure is perhaps more patent than an under-fissure; but epispadias is usually less extensive, unless in connexion with extroversion of the bladder, and it is certainly a much less common form of urethral deficiency. In a slight case, the Surgeon may well assure an anxious parent, that the boy will probably make as good a man as the father.

(2) *Absence of the Urethra* is occasionally met with, as in extroversion of the bladder; or the canal may be obliterated in a *portion* of its extent, or occluded merely by a membranous diaphragm, generally near the vesical orifice; or there may be a second meatus,—a variety of *hypospadias*, usually about an inch behind the normal one.

FIG. 463.



*Treatment.*—As a rule, it will be best to leave these urethral malformations alone; any such defect probably not having much functional importance, and being little improved by any operative procedure. When, however, the urethral deficiency exists to an extent which practically renders the person impotent; the hypospadias, or the epispadias, may perhaps be remedied by a plastic operation. The edges of the opened portion of urethra should be pared, and brought together by suture, over a catheter. Narrowing of the urethra may be dealt with by dilatation; and a membranous diaphragm perforated by a trocar, when its existence has been clearly ascertained.

## CHAPTER LXII.

### DISEASES OF THE SCROTUM, TESTIS, AND CORD.

**DISEASES OF THE SCROTUM.**—**INFLAMMATORY ŒDEMA** of the scrotal integument, is an affection of an erysipelatous character; and, owing to the loose structure of the sub-cellular tissue, it is attended with great effusion and swelling, with a marked tendency also to rapid sloughing. The skin becoming involved, the testicles and cords are soon exposed; and these organs may even hang pendulous entirely bereft of integument.

This affection is liable to occur in enfeebled persons, from any slight local cause of irritation; as a small wound, crack or abrasion; a boil or small abscess in or near the scrotum. Apart from the predisposing constitutional condition, sloughing of the scrotum rarely ensues. Thus, the scrotum is very seldom the seat of mortification from frost-bite; although such cases have been seen by Sir A. Cooper and Mr. Curling.

*Treatment* consists in elevation of the scrotum, with fomentations; and early, free incisions, on either side of the raphé, down to the most dependent parts of the swelling. Tension is thus relieved, and the tendency to sloughing. In the event of this issue, granulation and cicatrization proceed apace even after the most extensive exposure. Constitutional treatment must be conducted on ordinary principles, for sustaining the patient's strength during the consecutive processes of destruction and reparation.

*Anasarca* of the scrotum, in old, weak persons; should be met by puncture, rather than by incision.

*Œdema of the scrotum in new-born infants*, often occurs in consequence of some slight irritation of the skin. It subsides usually under careful attention to keep the part dry and powdered. Death, however, may ensue; a result which Professor Humphry witnessed in one case, and of which he cites two such cases.

**HYPERTROPHY OR ELEPHANTIASIS** of the scrotum, rarely occurs in this country, but is very common in tropical climates; especially China, India,—East and West, Egypt, and South America. It consists of a thickening of the scrotal integument, with infiltration of serum or oily matter; the latter being sometimes so abundant as to give to the whole the character of an oleaginous mass. The cremaster has been found thickened, and the spermatic cords elongated; but the testes are usually healthy. Hydrocele occasionally co-exists.

*Causes.*—A low chronic inflammation would seem to be the origin of



this disease; and it commences, either at some one point, thence spreading gradually over the scrotum; or as a tumefaction of the whole bag. There may be some locally exciting cause, as a fistulous tract; more frequently no source of irritation can be traced.

The part may remain smooth, or become tuberculated and corrugated; in either case, it has little or no tendency to ulcerate, unless in consequence of abrasion. Slowly increasing, without pain, the scrotal hypertrophy often attains an enormous bulk (Fig. 464), and weighs 50, 100, or even 150 lbs.; ultimately proving fatal by its distressing weight, or perhaps by the supervention of ulceration and incessant discharge. Ichthyosis not unfrequently co-exists in other parts of the body. Cases of Elephantiasis of the scrotum have been recorded by Clot-Bey, Mr. Liston, Sir W. Ferguson, Mr. Isaacson, Mr. Brett, Mr. Haynes Walton, Mr. Wiblin of Southampton; and as occurring in other parts of Europe, by Delpech, Larrey, Delusas, Auvert, and Nöggel.

FIG. 464.



*Treatment.*—In the early stage of this disease, it may perhaps be arrested by pressure and other means of allaying chronic inflammation of the skin. Such treatment failing to take effect, recourse must be had to the operation of excision, without delay.

*Excision.*—When the tumour is of moderate size, the testes and penis may be dissected out and saved; the hæmorrhage not proceeding to a dangerous extent. When the tumour has attained to a large size,—40 lbs. and upwards, it must be excised *en masse*, including the genital organs; the hæmorrhage of a partial excision would be so profuse as to be fatal during the operation; and even with the rapidity of complete excision, patients have sunk from loss of blood. In Mr. Walton's case, the scrotum was first tied in small segments close to the trunk, and the mass removed below the ligatures; then as each strangulated part was liberated, the vessels were secured. The scrotum weighed eight or nine pounds, and the patient recovered.

The general results of excision in this disease are shown by 161 cases wherein Mr. Esdaile operated, with the loss of only five per cent.

Tumours of the scrotum are rare. *Fibrous* tumour has, however, been known to occur in several instances, collected by Mr. Curling. It originates in the areolar tissue, is painless, and grows slowly; attaining sometimes to the enormous size of 20 or 30 lbs., and upwards. This species of scrotal tumour occasionally undergoes calcification; and some have been of the recurrent fibroid variety. The ordinary fibrous growth

has been removed successfully, even when of the largest size. *Fatty* tumour has been less frequently met with; and *Cystic* tumour is quite rare. Professor Humphry has met with only two recorded cases. Both the latter kinds of tumour have proved very difficult of diagnosis. Large *calculi* have every now and then been known to find their way from the bladder into the scrotum; thence escaping by ulceration or being excised.

*Cancer* of the scrotum is generally of the *epithelial* kind, and this occurs usually in chimney-sweeps. Hence the disease has been named *Chimney-sweeper's cancer* or *soot-cancer*. It appears to arise from the constant irritation by soot lodging in the folds of the scrotum, and is a common affection. Commencing usually as a flattened soft tubercle or wart of a leaden hue, and situated usually near the lower and fore part of the scrotum; this little lump slowly spreads, becomes indurated and covered with a crust or by a thick horny concretion. Subsequently ulcerating, an uneven open surface is exposed; having a sinuous edge with a hard tuberculated border and an indurated base, discharging a thin bloody fluid. Ultimately, the whole scrotum is destroyed, exposing the testicles, which are usually spared; and the inguinal glands become indurated. Death ensues from constant pain and continued discharge. The disease is then found to be a nearly local affection, not invading the lumbar glands or the abdominal viscera.

*Treatment*.—Free excision affords the only hope of cure, and this in proportion to the limitation of the disease. When it returns, the operation may be repeated; and again and again, even to the removal of the whole scrotum and testes, provided such free excision can remove the whole of the disease. Induration of the inguinal glands is no positive bar to the operation; for slight induration may afterwards subside or remain quiescent; while with greater induration and enlargement, these glands can perhaps be dissected out as part of the disease and operation of excision.

#### DISEASES OF THE TESTIS AND CORD.

Associated with the Testis and the Scrotum, the *TUNICA VAGINALIS* intervening between the two, may be the seat of certain diseased conditions; *Hydrocele*, and *Hæmatocele*, in their ordinary forms, as signifying either an accumulation of serous fluid, or an effusion of blood, within this serous sac. The spermatic veins are liable to undergo varicose enlargement, forming *Varicocele*.

Diseases of the *TESTIS* and *CORD* specially comprise five generic conditions;—(1) *Inflammation* or *Orchitis* and *Epididymitis*; (2) *Chronic Enlargement*—*Syphilitic*, and *Scrofulous*; (3) *Tumours*,—Fibrous, Cartilaginous, Cystic, Cancer; (4) *Atrophy* of the Testis; (5) *Functional Disorders*—Impotency, Spermatorrhœa, Neuralgia; *Congenital Malposition* of the Testis.

*HYDROCELE*.—In the widest acceptance of the term, Hydrocele signifies an accumulation of serous fluid, in connexion with the Testis or Spermatic Cord.

Ordinarily, the fluid is collected in the tunica vaginalis, enveloping the testis; sometimes, in a cyst or cysts, variously situated relatively either to the testis, or, in the course of the spermatic cord. Hence, Hydroceles may be divided into that of the *Tunica Vaginalis Testis*; and the *Encysted* forms, as relating either to the Testis or to the Cord.

An accumulation of serous fluid in the tunica vaginalis may occur in two conditions of the sac;—either, when the vaginal process of peritoneum has become obliterated, whereby the fluid is contained in a distinct sac,—constituting the *common* form of Hydrocele; or, when that tubular prolongation of peritoneum remains unobliterated, so that the fluid is contained in a sac which communicates with the general peritoneal cavity,—constituting *Congenital Hydrocele*.

*Hydrocele of the Tunica Vaginalis*.—The serous fluid is accumulated in a distinct sac, enveloping the testis; and this organ, somewhat enlarged, is usually situated at the lower and back part of the sac. Sometimes, the testis is flattened and spread out by constant pressure of the fluid; and the epididymis is then elongated, obliterating the pouch which naturally exists between the testis and epididymis. Or, the testicle may be separated from the back part of the sac by an increase of this pouch, which forms a second sac communicating with the general sac of the tunica vaginalis, between the testis and epididymis. Lastly, the testis may, occasionally, project into, and transversely across the hydroceleic cavity; forming a septum whereby the sac is divided into two compartments. The position of the testis is sometimes changed to the lower and fore-part of the sac, or it may lie wholly in front. The serous fluid is simply the natural secretion of the tunica vaginalis, or slightly modified by inflammation. Clear, and of a pale straw colour; this fluid may acquire a dark brownish or chocolate hue, in an old hydrocele, or rarely it has a white milky colour; in both cases becoming less transparent or opaque. In its composition, the fluid is albuminous, alkaline and saline; but there may be associated; fibrine in variable proportion, as indicated by spontaneous coagulation; or, red corpuscles of the blood, in a disintegrated state, when the fluid is dark coloured, with perhaps also flakes of cholesterine; or, products of inflammation occasionally, as flakes of lymph. In point of quantity, the fluid of hydrocele varies from six to twelve or twenty ounces, averaging less than a fluid pint; but it may have accumulated to double or treble that amount. The largest quantity I have ever tapped from a hydrocele, measured 52 oz.; the largest quantity on record was that removed from Gibbon, the historian, whose hydrocele when tapped by Mr. Cline, yielded six quarts!

*Signs*.—Serous fluid accumulating in the tunica vaginalis is attended with a swelling on the affected side of the scrotum, which presents certain distinctive characters. This swelling is at first soft and fluctuating under compression with the fingers, but it becomes tense and elastic as the sac is distended; it is translucent when examined by transmitted light. Increasing in size according to the quantity of fluid secreted, the swelling varies in magnitude from a hen's egg to a small cocoa-nut; occasionally, it attains to a size, which dragging over the penis, buries that organ, and extends downwards to or towards the knees. In point of shape, the swelling is at first oval; enlarging, it becomes pyriform with the large end downwards, thus corresponding to the shape of the distended tunica vaginalis; and there is often a slight transverse constriction about the middle of the tumour, apparently due to the lower border of the cremaster muscle, which thus gives an hour-glass appearance to the hydroceleic swelling. Little or no pain is experienced, only some tenderness in the testicle or epididymis; and a sense of weight or dragging-down as the hydrocele enlarges.

The mode of examining a hydrocele is very simple. Having handled



the swelling to ascertain its fluid character, by fluctuation or elasticity; the translucency may be shown by grasping the posterior part of the tumour, so as to render the integument of the fore-part tense; then placing a lighted candle on the one side of the tumour and looking through it from the opposite side; at the same time screening any direct light from the eye, by resting the hand edge-wise along the front of the scrotum.

*Varieties of Hydrocele* are met with, in consequence of changes in the sac, or the contained fluid. These changes are chiefly found in *old hydrocele*. *Thickening* of the sac often takes place, the tunica vaginalis acquiring the resistance of pasteboard; sometimes it becomes cartilaginous, or even osseous by the formation of bony plates on its interior. A *bilocular* or *multilocular* condition of the sac sometimes occurs; either as a result of pouch-like dilatations, or of inflammatory adhesions of the interior and the formation of septa dividing the sac into two or more compartments. The *serous fluid* is liable to undergo the changes of colour and opacity, already noticed.

Under these circumstances; fluctuation and translucency of the tumour become less and less marked as signs of hydrocele. The test by transmitted light may, however, yet be available when the examination is conducted in a darkened room.

*Hydro-sarcocele* signifies that variety wherein the testicle itself is much enlarged in conjunction with hydrocele.

*Diagnosis.*—Hydrocele is distinguished from *scrotal hernia*; by the translucency of the swelling, when this sign is present; by the tumour terminating abruptly at the external abdominal ring, instead of extending with a thick stalk upwards into the inguinal canal; by the sharp angle formed at the external ring, and hinge-like movement of the tumour, when it is tilted forwards; by the absence of impulse at that point, on coughing; by the lighter weight of hydrocele; and by the history of its development, as to whether the swelling commenced below, in the scrotum and ascended to the groin, or descended into the scrotum. The two conditions,—hernia and hydrocele, are not unfrequently *co-existent*; the hernial sac descending into the scrotum, in front, or behind, the hydrocele, on one side of it, or sometimes into the hydrocele. Out of six cases of the latter relative position, which Dupuytren witnessed; in two only, symptoms of strangulation resulted from constriction of the hernia at the line where it was engaged in the serous pouch of the hydrocele. From *cystic disease of the testicle*, hydrocele may be distinguished by the fluctuation extending all over the swelling, instead of being limited to some part of the tumour. From *hæmatocele*, or a collection of blood in the tunica vaginalis, hydrocele is known by its translucency; when non-transparent, recourse must be had to the aid of puncture by a trocar, as the turning point of diagnosis.

*Double hydrocele*, one on each side of the scrotum, occurs in about an equal number of cases.

*Causes.*—The serous fluid in the tunica vaginalis,—forming hydrocele, is only an excessive quantity of that which naturally moistens the internal surface of the tunic; and its accumulation results from loss of balance between secretion and absorption. This change seems to be dependent on long-continued irritation, and often arises from a blow, or other external violence. One of the largest hydroceles I ever knew, was produced by a blow from a cricket-ball. Inflammation may also be induced in like manner; giving rise to hydrocele, and an effusion of lymph mixed with

the serous fluid. Hydrocele occurs most frequently about middle life, and in persons of a weakly constitution, or an enfeebled state of health.

*Treatment.*—Arrest of the secretion and resorption, of the serous fluid, cannot be induced by any known medicinal treatment, topical or constitutional. In this respect, hydrocele resembles similar effusions in hydrocephalus, hydrothorax, hydrops articuli, &c.

The treatment adopted may be *Palliative*, by tapping; or *Curative*, by tapping, and the injection of some stimulating fluid to induce inflammation or inflammatory adhesion; or, as a last resource, by the introduction of a seton for the same purpose.

*Palliative Treatment.*—Tapping a hydrocele is performed by means of a fine trocar and canula, in the following manner. The Surgeon having ascertained the position of the testis, usually at the lower and back part of the scrotum, he grasps the posterior part of the tumour so as to make tense the skin in front; then, selecting a spot about the middle of the projecting surface, and in an interspace between the veins; he thrusts a fine trocar and canula in a perpendicular direction backwards into the hydrocele, taking care not to push the instrument so far back as to wound the testicle, when the hydrocele-sac yields suddenly before the point of the trocar. (Fig. 465.) The object of thus avoiding the veins and of directly transfixing the skin and sac of the hydrocele, is to prevent any effusion of blood into the intervening cellular tissue (Fig. 466), which might lead to sloughing; while the testicle is avoided by observing the precautions in handling the tumour and as to the limited depth of the instrument. On withdrawing the trocar, the fluid is drawn off through the canula, which is then itself withdrawn, and the puncture-spot covered if necessary with a small piece of plaster.

FIG. 465.



The relief afforded by this procedure is, usually, only temporary; the fluid is almost certain to re-accumulate in the course of a few months. Tapping may then be repeated, and on several subsequent occasions, whenever requisite to relieve the weight and inconvenience of the hydrocele. In healthy subjects and small hydroceles, palliative treatment, by a single or repeated tapping, sometimes proves a radical cure.

*Curative treatment.*—This may be effected by means of a stimulating injection, or by the introduction of a seton.

*Injection.*—Tapping having been performed as already described, some stimulating fluid is injected through the canula by means of a small glass syringe. Various fluids have been used; port-wine, spirits of wine, sulphate of zinc in the proportion of a drachm to the pint of water; but the most effectual kind of injection is tincture of iodine, to the amount of two or three drachms. The injection may be allowed to remain in the

sac; or allowed to escape, after the lapse of a short period varying from a few minutes to half an hour, according to the practice of some Surgeons.

Two practical points should be observed in using the injection; firstly, that the slit in the canula be completely within the tunica vaginalis, before throwing in the fluid (Fig. 466); secondly, while withdrawing the

FIG. 466.



canula, the sac should be nipped against it between the finger and thumb. Both these precautions are with the view of preventing any escape of the injection into the cellular tissue between the skin and sac; an accident which would probably be followed by diffuse inflammation and sloughing.

*After-treatment* is simple. The patient should rest for a few days. In the course of twenty-four hours, inflammatory effusion will have taken place into the sac, and the swelling may be reproduced to nearly its original size, looking almost as if the hydrocele had not been tapped. This is a good sign, announcing the probability of a radical cure ensuing. The degree of pain produced is no criterion of the curative efficacy of injection. At the time of operation, sudden and severe pain may occur immediately the stimulating fluid touches the tunica vaginalis, and becomes excruciating; yet

without much if any inflammation being excited. Conversely, there may be little pain and much inflammation. According to the degree of inflammatory swelling induced, it will be necessary to regulate the process; by handling the scrotum on the affected side to promote effusion, or by cold lotions to moderate it.

The cure of hydrocele seems to be effected in two ways; either in consequence of adhesive inflammation, whereby the cavity of the tunica vaginalis is obliterated more or less completely; or, by the mere passing of inflammation upon this membrane, whereby its secretory power is so modified as to restore the balance between absorption and secretion of the serous fluid which naturally lubricates the surface of the tunic. Failures occur; either by an absence of inflammation; or by an excess, with undue effusion or deficient absorption of the superfluous effusion, the tunica vaginalis remaining distended with fluid. Suppuration very rarely supervenes; Sir B. Brodie witnessed it in three cases, and Mr. Curling has seen one such case. Occasionally, the hydrocele has returned, and then gradually disappeared. But generally the cure by injection is permanent, entitling it to be designated the *radical* cure of hydrocele; although sometimes the fluid has returned after a lapse of years.

The *results* of iodine injection have been very satisfactory, both as regards its safety, and success in the cure of hydrocele. It excites inflammation of a moderate and uniform degree, rarely very severe, yet generally sufficient for the purpose. The proportion of failures have been variously estimated; in India, where iodine injection was originally introduced by Sir R. Martin, the failures scarcely amount to 1 per cent.; in France, Velpeau calculates them at 3 per cent. In this country, it has also proved very successful.

*Seton*.—The cure by the passage of a seton should be reserved ex-



clusively for the few cases wherein injection has failed. After tapping the hydrocele, a long needle armed with a seton of silk, is passed up the canula and drawn through the upper part of the scrotum; then the canula is removed, the needle cut off, and the thread knotted loosely. This is allowed to remain until sufficient inflammatory effusion has been induced; usually in a period varying from twenty-four to thirty hours, but occasionally extending to ten or twelve days. Little inflammation may have ensued, yet a radical cure may result. I have never had occasion to employ this method.

The radical cure—whether by injection or seton—should be practised only under certain circumstances, with regard to the size of the hydrocele and the patient's state of health or age. These precautions are necessary in relation to the safety and efficiency of the radical cure.

*Large* hydroceles, one, for example, containing a quart of fluid, should not be injected; the consequent inflammation of so large a sac, might prove overwhelming and terminate fatally. Such a hydrocele may be tapped; and in a short time, emptied again when the sac has undergone contraction; then this smaller sized sac can be safely and effectually injected. An enfeebled state of health, or persons advanced in life, should not be subjected to the risk incurred by injection. Tapping may be resorted to as occasion requires.

*Congenital* Hydrocele presents a few points of importance with regard to its diagnosis and treatment.

The vaginal process of peritoneum remaining open, as a tubular prolongation communicating with the general peritoneal cavity; this condition of the hydroceleic sac gives rise to certain characters, which distinguish it from ordinary hydrocele, and from scrotal hernia. The serous fluid accumulated in the sac can be returned by pressure, into the abdomen, especially in the recumbent position; and the sac gradually refills again when the pressure is removed from the external abdominal ring, and the patient stands up. In both these respects, congenital hydrocele essentially differs from common hydrocele. But it resembles hernia. This may, however, be distinguished by its opacity; and in the non-congenital form of hernia, by the more perceptible presence of the testicle at the lower part of the scrotum.

*Treatment.*—*Repressive* measures, by cold lotions and mild aperients, may sometimes cause the swelling to subside. When repression fails; the hydrocele should be emptied of its contents into the abdomen, by gently compressing the scrotum on the affected side, and a truss applied to the external ring, as for inguinal hernia. The process of peritoneum may now undergo contraction and become obliterated; thus reducing the sac to that of a common hydrocele. Then, in this state; *tapping*, or with *injection* as the radical cure, may be practised.

*Encysted Hydrocele.*—This form of hydrocele consists in the production of a cyst or cysts, containing a thin watery fluid; and projecting from some part of the testis or epididymis. It differs from common hydrocele in its relation to the testicle; being situated above, or below, or to one side, of this organ, instead of enveloping it. Sometimes, however, the cyst projects into the sac of the tunica vaginalis, distending it as if the fluid were contained in its cavity.

The *signs* of encysted hydrocele are, as in ordinary hydrocele, a swelling, fluctuating and transparent; but having the above-mentioned different relations to the testis; and as the cyst increases, the testicle is

borne upon its wall, thus further altering the relative position of the organ. The fluid contained in the cyst is of a thin watery character, instead of being a yellow serous fluid; and it is remarkable for abounding in spermatozoa—a peculiarity discovered by Liston. In both these particulars, the fluid of encysted hydrocele differs also from that of ordinary hydrocele. When this cyst projects into the tunica vaginalis, simulating common hydrocele, the only possible distinction may be, the nature of the encysted fluid as shown by puncturing with a trocar.

*Treatment* is precisely the same as that already described. The radical cure, by iodine injection, is not so uniformly successful as in ordinary hydrocele; but, if it fail, incision of the cyst has been recommended, in order that it may granulate from the bottom and thus become obliterated. Encysted hydrocele may sometimes be left alone; the cyst attaining to a certain size, and then remaining stationary for years.

*Hydrocele of the Spermatic Cord.*—This form of hydrocele is characterized by the presence of a cyst, containing serous fluid; and situated in some part of the spermatic cord. It may be near the testicle, or within the inguinal canal and near the internal abdominal ring; or at any intermediate point. But the cyst is always distinct from the testicle or the tunica vaginalis.

The *signs* are those of a round or oval tumour, rarely attaining to a larger size than a hen's egg; elastic, and translucent when it can be examined by transmitted light. It is moveable, unaffected by compression, and receives no impulse on coughing; unless situated in the inguinal canal, when—owing to its mobility up and down the canal, according to the recumbent or standing position of the patient—the apparent diminution under compression and some impulse on coughing, will render the diagnosis from inguinal hernia most difficult.

The formation of any such cyst in the spermatic cord seems to be generally due to an unobliterated portion of the vaginal sheath of peritoneum which accompanies the cord; and which, at that part, becomes distended by an accumulation of fluid in it. Sometimes, the cyst arises as a distinct cystic-formation, connected with the cord. Hydrocele of the cord occurs most frequently in children or young boys; although it may be met with at all ages.

*Treatment* should be conducted on the same principles as for other hydroceles, by tapping and stimulating injection, or the introduction of a seton; or by an incision to induce granulation from the bottom of the cyst.

*Diffused hydrocele of the Cord*, has been described by Pott and Scarpa; and, as a variety of hydrocele, has found its way into Surgical works. If it ever occurs, it is probably, simply an œdema of the cord, and not any kind of cyst-formation.

*Treatment* would have to be conducted on ordinary principles; counter-irritation by blistering, or incision of any localized swelling to discharge the fluid and provoke consolidation.

**HÆMATOCELE.**—By hæmatocele is meant an effusion of blood into the *tunica vaginalis*; or in a cyst connected with the testicle or cord—*encysted hæmatocele*.

The enclosed blood varies in quantity and condition. In the latter respect, the blood may be a sanguineo-serous fluid, or pure blood. It may be clotted, mingled with fluid, or become uniformly coagulated and laminated in layers, as in an aneurismal sac. Or, the coagula have undergone various states of decolorization and disintegration. The containing

tunic or cyst, usually becomes thickened, perhaps to a considerable extent, amounting even to an inch in thickness, and involving the surrounding cellular texture; as the result of inflammation induced by the presence of effused blood. In hæmatocele of the tunica vaginalis, this thickening involves also the tunica albuginea, but not the substance of the testicle, which remains healthy; although atrophied from constant pressure by the distended sac, or by the contraction of its own thickened tunic. Lymph is sometimes effused, as a product of inflammation, on the inner surface of the tunica vaginalis, there being mingled with the blood.

The *cause* of Hæmatocele is *traumatic*; a blow, or squeeze of the testicle; a strain, as affecting the cord; or other mode of violence. In hæmatocele of the tunica vaginalis; the source of the blood is some ruptured vein in the tunic, or a small rent in this membrane, or it may be a wound of a vessel in tapping hydrocele. *Spontaneous* hæmatocele is also said to occur, apparently from rupture of an enlarged spermatic vein.

In hæmatocele of the cord, rupture of an enlarged spermatic vein is the source of effusion.

*Hæmatocele of the Tunica Vaginalis.*—An effusion of blood into the tunica vaginalis may occur as an original affection, or supervene upon hydrocele.

*Signs.*—In both cases, a swelling is presented, which slowly and gradually increases in size, until it attains to that of a duck's egg or a cocoa-nut, or even to that of a melon. The swelling is more or less fluctuating, and opaque. Sometimes, ecchymosis of the scrotum is produced, whereby the tumour has a characteristic dark-coloured or black appearance; which, however, gradually disappears.

*Diagnosis.*—When the hæmatocele is a primary affection, its sudden appearance is distinctive; especially when the swelling is known to have immediately followed a blow, and is not the product of inflammation. When a hydrocele suddenly enlarges and loses its transparency, an effusion of blood has probably taken place. Ecchymosis of the scrotum, in either case, will confirm the diagnosis. *Chronic* hæmatocele, and without any ecchymosis, may be mistaken for other tumours in the scrotum. The diagnosis must then be determined by the distinctness of fluctuation, the rate of increase of the swelling, and its cause. *Cancer* of the testicle may be mistaken for hæmatocele; in numerous instances, malignant testis has been opened for hæmatocele; and the more serious error has been committed, of removing an hæmatocele for malignant disease. The most constant distinction is the steadily increasing growth of cancer, whereas hæmatocele sometimes ceases to enlarge or even diminishes in size. Puncture of the tumour should always be resorted to as the turning point of diagnosis, before proceeding to remove the testicle.

*Treatment.*—In *recent* hæmatocele, and where the blood yet remains fluid, absorption may, perhaps, be induced; by rest, cold lotions or leeches, according to the inflammatory state of this affection. Even when hæmatocele supervenes on hydrocele; this treatment has proved effectual, without any operative interference.

In more *advanced* and chronic hæmatocele, the state of the blood, as being fluid or solidified, will mainly determine the requisite operative procedure. *Fluid* blood can be evacuated by tapping; and with iodine injection, a radical cure may be effected, as in hydrocele. The admixture of a proportion of blood with serous fluid, will probably not frustrate this method of cure. In hæmatocele, as in hydrocele, the variable position



of the testicle should be remembered in puncturing the tunica vaginalis. Commonly, situated at the back of the sac; the testis was found in front, and was wounded, in two cases recorded by Mr. Curling. *Solidified*, or firmly coagulated blood, cannot be evacuated by puncture; it will then become necessary to make a free incision so as to lay the tunica vaginalis entirely open, to turn out the clots, and wash it out thoroughly by syringing. Otherwise, any remnant blood undergoing decomposition in the sac, sloughing and systemic infection are liable to ensue. Profuse hæmorrhage has, however, been known to follow free incision; a source of danger which cannot be avoided.

When the hæmatocele has attained a very large size, and the tunica vaginalis has become much thickened; castration, in order to remove the entire mass with the testicle, may be the safest procedure. This will be especially advisable in elderly persons.

*Encysted Hæmatocele of the Testis, or of the Cord.*—Cysts, containing blood, are occasionally met with; both in connexion with the testis, and the spermatic cord.

In connexion with the *Testis*, it may be difficult, or impossible, to distinguish encysted hæmatocele from ordinary hæmatocele of the tunica vaginalis. Hæmatocele of the *Cord*, arising from a strain or other violent exertion, presents a cystic swelling in some portion of the spermatic cord; but it is always distinct from the testicle or the tunica vaginalis. Commencing usually within the inguinal canal; the tumour has a round or oblong shape, and increasing in size, it extends downwards through the external ring into the scrotum, where it may attain an enormous size. In one remarkable case, related by Bowman, the tumour, after existing for ten years, had reached down to the patella, and was so heavy as to require both hands and a considerable effort to raise it from its bed. The swelling is semi-elastic, but opaque, when of sufficient size to be examined by transmitted light. As in hydrocele of the cord, hæmatocele of the cord is moveable, unaffected by compression, and receives no impulse on coughing. These characters distinguish it from hernia, unless when situated within the inguinal canal, where the diagnosis is often most difficult.

*Treatment.*—In the *recent* condition of Encysted Hæmatocele,—the blood remaining as yet fluid; remedial measures may be directed to promote absorption, by rest and evaporating lotions. An incision, in this state of the hæmatocele might lead to fearful hæmorrhage from the ruptured vein.

In an *advanced* condition, the mode of treatment must vary according to the fluid or solidified state of the blood. Tapping, or coupled with iodine-injection, will now become appropriate; or an incision, to turn out the coagula, in order that the cyst may granulate and heal from the bottom.

*VARICOCELE.*—An enlarged and varicose condition of the spermatic veins, known as Varicocele, is attended with certain marked characters.

*Signs.*—A swelling, of an ovoid or pyramidal shape with its base downwards, forms between the testicle and external abdominal ring; usually on the left side of the scrotum. This swelling feels knobbed and convoluted; slipping about between the fingers as if it were a *bundle of worms*. It is inelastic and compressible, but the swelling gives a slight impulse on coughing, and it slowly diminishes in the recumbent posture, reappearing in the erect position and increasing after long standing even although moderate pressure be maintained on the external ring. The

enlarged veins may often be seen through the thin scrotal skin. There is little or no pain, but a sense of tension and weight, which is at once relieved when the patient lies down. Sometimes, the swelling becomes temporarily painful. The testicle undergoes a certain amount of atrophy, and when much reduced in size, it may be almost concealed beneath a large varicocele. Double varicocele sometimes occurs, but that on the left side is even then the most developed.

The *diagnosis* of varicocele from scrotal hernia may be readily determined by the peculiar feel of the swelling; although both the tumours have some resemblance, in being affected by coughing and by posture. From hydrocele of the tunica vaginalis, or of the cord, varicocele differs in virtue of all these characters; and as regards the former hydroceleic affection, varicocele has the additional distinction that it does not extend down to the testicle so as to envelope this organ.

The *causes* of varicocele are both predisposing, and exciting. *Predisposition* consists in the anatomical constitution of the spermatic veins;—their size and tortuosity near the testicle, their numerous anastomoses and long efferent trunks, favouring the accumulation of blood, and the loose cellular texture of the scrotum affording little support; while the veins are frequently subjected to pressure by the action of the abdominal muscles. The specially predisposing circumstances usually assigned for the far more common occurrence of varicocele on the left side, are; the slightly lower position of the left testicle, the angle of junction of the left spermatic vein with the renal, and its relation to the sigmoid flexure of the colon as a source of compression. In respect to age, varicocele commences usually at about eighteen or twenty; and in about one male adult in ten. The *exciting* cause may be any exertion which tells upon the spermatic veins; as straining at stool, long walking exercise, standing, or riding. Any such exertion, having induced varicocele, will also aggravate it from time to time.

*Treatment.*—The necessity for any interference with varicocele should be determined by various circumstances; an increasing size of the swelling, the inconvenience or pain occasioned by it; the tendency to atrophy of the testis, and sometimes to spermatorrhœa; with the mental depression induced by this state or resulting from prolonged anxiety respecting the supposed loss of generative power. These circumstances will also indicate the propriety of palliative measures, or of having recourse to the radical cure by obliterating the affected veins.

*Palliative* treatment consists; in wearing a scrotal suspensory bandage or an elastic bag, to support and slightly compress the enlarged veins; or a well-adjusted truss with the pad upon the external ring, to prevent any sudden reflux of blood into the veins during exertion. The latter appliance has proved an effectual cure in some instances, which Mr. Curling mentions, after the truss had been worn some months; and in which the testicle, partially atrophied before the treatment began, regained its natural size. Certain means have also been tried in accordance with the principle of scrotal support, by lessening the *size* of the bag. This has been done by drawing a portion of the scrotum through a soft metallic ring covered with wash-leather, or a vulcanized india-rubber ring; a method of treatment originally suggested by Mr. Wormald. Or, a portion of the scrotum has been excised, with the same object in view; but, this plan is too uncertain as to its efficacy to justify its severity, as a palliative measure.

During any occasional period of pain, or tenderness in the affected

veins; the recumbent posture and rest, a cold evaporating lotion and saline aperients, will give relief.

*Curative treatment.*—Obliteration of the enlarged and varicose veins has been attempted by various operative procedures: by compression with forceps fixed on the scrotum; compression by hare-lip pins and twisted suture; subcutaneous compression between a pin and wire rolled round it; subcutaneous ligature; subcutaneous incision; and by ligature and incision combined.

The methods most frequently practised are; subcutaneous ligature, as proposed by Ricord; and subcutaneous ligature at two points, with intermediate subcutaneous division, as proposed by Mr. H. Lee.

Ricord's *subcutaneous ligature* is thus described by Mr. Curling:—The vas deferens being separated from the mass of veins, and the latter being pinched up with a fold of the scrotum, a needle set in a handle with an eye near the point, armed with a double-looped thread, is to be passed beneath them. When the needle has traversed from one side to the other, the loop is to be drawn out, the needle retracted, and the veins let go, the skin alone being now held up. A second needle, similarly armed, is then to be passed through, over the veins, entering at the same aperture by which the first needle was thrust out, and emerging at the same aperture by which it entered. The second loop is next to be drawn out, and the needle withdrawn. The bundle of veins is thus included between two threads, one passing over and the other beneath it. The ends of the thread on each side are then to be passed into the loop of the other, and by drawing these ends in opposite directions, the veins are tied beneath the skin. The vessels become divided, and the ligatures separate from the tenth to the twentieth day.

A *simple* mode of subcutaneous ligature is that performed by Mr. Erichsen. Having separated the vas deferens from the veins, a small incision is made, about half an inch long, in the front and back of the scrotum; then a needle armed with silver-wire is passed between the vas

and the veins, so as to be brought out behind, and the needle returned in front of the veins; thus these vessels are included in a loop of wire, without implicating the scrotum. The loop is then tightly twisted, whereby the enclosed veins are constricted. By repeated tightenings, the wire gradually effects a passage by ulceration through the veins, which are obliterated by the same process.

*Compression by two Pins, and intermediate subcutaneous division of the Veins.*

—This mode of obliterating the spermatic veins, is the same as that for varicose veins in the leg. The operation is performed in precisely the same way (Fig. 467); care being taken to exclude the vas deferens, which is easily recognised by its round, firm whipcord character.

These operative procedures have been variable in their results. Great relief or a cure has been effected in several instances; and I have been accustomed to practise the last-named operation with a fair proportion of success. On the other hand, no good has been produced, the operation

FIG. 467.





proving abortive; or only a temporary cure has resulted, the varicocele returning at no distant period. Diffuse inflammation and sloughing of the scrotum, or phlebitis and death, have been known to occur. Atrophy of the testis may be mentioned as an occasional result; but this will probably be avoided by not cutting off the supply of blood entirely, in any procedure for obliterating the enlarged veins. The whole of the veins should not be included in the ligature, or subjected to compression and division; and the spermatic artery should be excluded, a precaution easily observed by keeping free of the vas deferens, near which the artery lies.

**INFLAMMATION OF THE TESTICLE.**—This subject comprises *Orchitis*, when the testicle itself is the seat of inflammation; and *Epididymitis*, when the epididymis is primarily affected. *Chronic* Enlargement of the testis or of the epididymis, resulting from special causes of inflammation, may be Syphilitic or Scrofulous. These affections will be afterwards considered.

**ORCHITIS and EPIDIDYMITIS.**—Inflammation of the Testis occurs less frequently than that of the Epididymis. But either part being primarily affected, the other becomes involved; and thus Orchitis and Epididymitis are usually found associated.

*Symptoms.*—Swelling arises, which has the characteristic shape of the part wherein the inflammation is seated; whether the testis, presenting an ovoid swelling; or the epididymis, when its inferior globus presents a nodular enlargement, or the whole of the epididymis, in the form of an elongated mass at the back of the organ, can be readily distinguished. As the swelling rapidly increases, it soon becomes tense and hard, especially in the testis, owing to the resistance of its more unyielding tunic; and it attains to a considerable size, that of an orange or even a small cocoa-nut. Effusion often takes place into the cavity of the tunica vaginalis, as well as into the substance of the gland, of the epididymis, or of both these structures; and thus the swelling may be exaggerated beyond what really pertains to the testicle. Pain accompanies the swelling, and it increases in severity proportionately to the tension of the part; with a sense of dragging weight, or a dull, heavy aching, and sickening pain, extending up the cord into the groin, iliac region and loins. The scrotum becomes tender, distended and reddened, exhibiting also a congested state of the serotal veins; as the integument and sub-cellular texture participate in the inflammation. Sharp inflammatory fever attends the development of the disease; and there is usually considerable nausea or even vomiting and constipation, simulating strangulated hernia.

*Causes.*—Various *injuries* of the testicle and sources of *urethral irritation*, may give rise to orchitis or epididymitis; and certain constitutional diseases have a predisposing influence, or may directly induce these inflammatory affections. Thus, exciting causes comprise; a blow, squeeze, or wound, of the organ; urethral irritation, especially near the orifices of the seminal ducts; as by gonorrhœal or other inflammation of the urethra, stricture, or the introduction of instruments, the impaction in, or the passage through, the urethra, of a calculus; injury to the vas deferens in lithotomy or in puncture of the bladder per rectum. The various sources of irritation in the urethra, or occasions of injury to the seminal ducts, more commonly give rise to epididymitis than to orchitis; although the testis often becomes secondarily inflamed.

The causative *operation* of urethral irritation in exciting inflammation of the epididymis, is doubtful. It does not arise from gonorrhœa until

the urethral inflammation is subsiding, and when perhaps discharge alone remains. Some slight external cause of irritation, such as active walking exercise, riding on horseback, or the friction of tight trousers, may then produce epididymitis. Sudden suppression of the urethral discharge seems to give rise to this inflammation, by *metastasis*; or the discharge continuing, it would appear that the morbid action extends along the *vas deferens* from the urethra to the testicle. But of this mode of causation, there is no sufficient evidence. The inflammation can only be designated *sympathetic*.

Of *constitutional* causes; mumps more frequently affects the testis than the epididymis, but the inflammation may commence in either part and extend to the other; syphilis, scrofula, gout and rheumatism, especially gonorrhœal rheumatism, may also severally predispose to, or induce, inflammation either of the testis, or of the epididymis. Excepting however, syphilis, which chiefly affects the testis; the scrofulous, gouty and rheumatic diatheses, generally induce epididymitis, the testis becoming secondarily affected.

*Terminations*.—Acute inflammation of the testicle or of the epididymis, usually subsides by *resolution*, in a period varying from a week to a fortnight or longer. As the disease declines, the distinctive characters presented by the enlargement of the two constituents of the organ, again become apparent. The testis first resumes its natural size and shape; the epididymis often continuing enlarged, irregular, and hardened, for a considerable period. Ultimately, when the structural condition of the organ is restored, its functional power remains unimpaired. *Atrophy* is sometimes the result of inflammation; exceptional cases of this kind, in consequence of mumps, have been seen by Dr. Hamilton, M. Rilliet, and Professor Humphry. *Suppuration* rarely occurs, though I have seen it in one case.

*Treatment*.—In the *acute* stage.—Local blood-letting is a most effectual means of subduing the inflammation, whether as orchitis or epididymitis. Blood may be abstracted by the application of leeches to the scrotum, or by puncturing the congested scrotal veins. The latter method is preferable, as leech-bites are apt to become centres of inflammation. Puncturing is most conveniently commenced at the lower part of the scrotum, so that the blood trickling from the veins first opened, shall not obscure the vessels above. Warm fomentations should then be applied, whereby double the quantity of blood may be drawn off than would otherwise be abstracted. Six or eight ounces of blood having been taken in this way, rest in the recumbent position with the scrotum well supported by a pillow or handkerchief, will complete the local treatment in the acute stage of inflammation. It has been proposed to puncture the *tunica albuginea* at different points, in order to reduce the tension resulting from this fibrous tunic; and I have heard that great relief and even a cure, has been thus speedily obtained, in several instances. I have had no experience of this resource; but it would seem to be at least unnecessary, seeing that the inflammation is amenable to ordinary antiphlogistic measures. *Constitutional* treatment consists, in the administration of antimonial saline aperients, combined with hyoscyamus or other sedatives. When, indeed, the inflammation follows gonorrhœa; hyoscyamus in full doses with camphor mixture, will, I have found, often prove sufficient to subdue the pain and swelling; unaided by any other medicinal agents. This method of treatment, was I believe, originally proposed by Mr. Gay.

Pressure, as by means of strapping the testicle, has been highly recommended in the acute stage, by Fricke of Hamburg; but at this period, it generally increases the inflammation, or at least intolerably aggravates the pain.

*Chronic enlargement*, resulting from acute inflammation, is best reduced by strapping. Simple adhesive plaster may be used; or the em-plastrum ammoniaci cum hydrargyro and soap-plaster, as affording both pressure and a stimulant application.

*Strapping* a testicle is a simple proceeding, but requires to be done so as to give uniform support. Several strips of plaster must be provided, each about an inch broad, and of sufficient length to embrace the enlarged testicle, vertically and horizontally. The scrotum having been shaved, it should be drawn well upwards on the side of the enlargement. Then, a long strip of plaster is passed from under the scrotum above the enlarged testicle, and brought round the corresponding side of the scrotum, so as to isolate the testis from the opposite side. Strips are then passed in succession, longitudinally and horizontally, each strip overlapping the next, and drawn moderately tight; thus uniformly enveloping and moderately compressing the whole organ. Care should be observed not to strangle the scrotum above, as sloughing has been known to ensue.

*Chronic Enlargement of the Testicle, or Sarcocoele.*—This condition of the Testicle may be the result of *simple* inflammation, having a traumatic origin; or it may be a manifestation of certain *constitutional* diseases,—Syphilis or Scrofula. Thence, three varieties of Sarcocoele may be recognised, in regard to their *origin*. But the attempt to carry their distinction further has failed to establish any *essential* points of pathological difference;—in respect to the structural condition of the chronic enlargement, its signs or external characters with regard to diagnosis, and its terminations. The peculiar treatment requisite will of course depend upon the origin or cause of the Sarcocoele.

These remarks apply more especially to Syphilitic and Scrofulous Sarcocoele. In considering the general pathology of the Constitutional Diseases, of which these two varieties of Sarcocoele are, occasionally, local manifestations; their structural conditions, signs, and terminations, were sufficiently described. It remains only to consider the treatment of these conditions of the testicle, with a recapitulation of their pathology.

*Syphilitic Sarcocoele.*—In this variety of chronic enlargement of the testicle, the gland itself is chiefly affected, and less frequently the epididymis. It consists of a fibrinous deposit, in the form of nodules, situated in the *interstitial connective tissue* of the glandular structure, in the septa, mediastinum, and tunica albuginea; and sometimes extending into the connective tissue of the epididymis. Thence, the organ becomes considerably enlarged, to the size of a turkey's egg, or perhaps of a cocoa-nut; it has an ovoid shape, is heavy, hard, and *nodulated*. But, when the deposit is principally central, the organ may be smooth externally. An effusion of fluid sometimes takes place into the tunica vaginalis, constituting hydro-sarcocoele; a condition which masks the enlargement of the testicle, until the fluid is evacuated. There is little or no pain, only the inconvenience of the dragging weight. The diagnosis, however, must be determined by the syphilitic history.

The *consequences* of this enlargement are; atrophy of the glandular structure, owing apparently to contraction of the interstitial fibrinous deposit; as in cirrhosis of the liver. Nevertheless, the tubuli seminiferi



sometimes become involved; their walls being thickened and blended with the intervening tissue, according to Virchow, while the epithelium lining them undergoes pigmental and fatty degeneration. The function of the organ will be proportionately and permanently impaired or destroyed. This tendency is particularly noticed by Vidal (de Cassis), who, however, gives instances of recovery of function in testicles which had been severely invaded by syphilitic orchitis. Suppuration may ensue, as a consequence of the chronic enlargement; forming an abscess in the substance of the testicle. The pus may degenerate into a caseous, calcareous or earthy mass; but usually, the abscess increasing, at length contracts adhesion with the tunica vaginalis and scrotal integument, and then bursts through the tunica albuginea, and discharges externally. The aperture having continued for a time, closes permanently; or a succession of abscesses, form, burst, and heal. Any such abscess of the testicle having burst, is not unfrequently followed by ulcerative enlargement of the aperture, and protrusion of a portion or whole of the organ,—forming hernia testis. The integument thickened and indurated, constricts the protruded portion; and granulations springing up, give an expanded appearance to the protrusion, beyond what is really testicular.

*Treatment.*—When syphilitic sarcocele has not been long established, the deposit may be influenced somewhat to undergo absorption, by means of medicinal agents; without injuriously affecting the general health, or damaging the remaining tissue of the organ. A mercurial course, combined with tonics, often proves beneficial; the bichloride of mercury, in doses of the twelfth or eighth of a grain, with quinine, three times a day, and continued for six or eight weeks. Iodide of potassium may then be advantageously substituted, until the hardness and swelling disappear. *Strapping* the testicle, as already explained, with adhesive or mercurial plaster, is less effectual in promoting absorption; and occasionally it seems to arouse the inert deposit to suppuration.

*Scrofulous Sarcocele*—This variety of chronic enlargement of the testicle differs only from that of syphilitic origin, in two particulars; generally, the epididymis, and even the vas deferens, is primarily the seat of scrofulous deposit; and this is at first contained *within* the tubules. The *nodular* form of enlargement is usually presented; and as the testicle itself soon becomes implicated, the whole organ is enlarged and irregular, at an early period of the disease. Tubercular deposit, in the form of gray, semi-transparent, granular tubercles—as found in the lungs—represents the kind of deposit in the enlarged testicle; thence named *tuberculous* sarcocele. Hydrocele sometimes ensues, disguising the testicular enlargement, until the fluid is evacuated.

The almost painless character of the disease, as in syphilitic sarcocele, reduces the diagnosis of these two varieties of sarcocele to the external characters of the enlarged testis; and as these are not positively distinctive, the nature of the disease can only be determined by the co-existence of other Scrofulous affections or tendencies. Thus, the condition of the lungs should be examined, and that of the prostate and seminal vesicles; the latter parts being not unfrequently also enlarged by scrofulous deposit.

The *consequences* of scrofulous sarcocele are not peculiar; but the tendency to suppuration and abscess, followed by hernia testis, is even more marked than in syphilitic sarcocele. There is also abscess in the epididymis extending up the vas deferens, and converting their hardened enlargement into a fluctuating bag of pus.

*Treatment.*—Constitutional and hygienic measures are more likely to prove beneficial than any local treatment. Tonics, principally iron or the iodide of iron and quinine, with cod-liver oil, should be taken for a considerable period; the diet must be well regulated, and other means adopted for the improvement of the general health. At the same time, the iodide of lead ointment, and strapping the testicle, may have some locally curative influence of subordinate importance.

*Abscess* in the Testicle, as the result of inflammation of this organ, occurs sometimes from syphilitic orchitis, but more commonly from scrofulous orchitis. The *signs* of this condition are in no way peculiar, and the *treatment* must be conducted on ordinary principles.

*Hernia Testis*, or protrusion of the testicle, is apt to follow the bursting of an abscess. The appearances have been already described. It presents, usually, a red, granular, fungous mass; but varying according to the state of inflammation, sloughing, or granulation. The mass becomes expanded over, and is constricted by, the margin of the aperture in the conjoined tunica albuginea, tunica vaginalis, and indurated scrotal integument.

*Treatment.*—According to the *size* of the protrusion, the attempt may be made to repress it, or it will be necessary to remove the mass. When of small size, a cure may often be effected by pressure; some lint or charpie spread with the ointment of red oxide of mercury is laid upon the protrusion, and well strapped down with strips of plaster. Or, the integument may be detached on either side of the protrusion, the edges pared, and brought over it in front, and retained by suture; pressure being thus applied, as suggested by Mr. Syme. Another plan, devised by Dr. Pagan of Glasgow, consists in dissecting down to the tunica albuginea, and then incising the margin of the aperture in that tunic, like the ring in strangulated hernia. After this, the treatment is said to be much more successful.

When either of these plans have failed, or the protrusion is of larger size; it should be removed by shaving it off with a bistoury. During the process of granulation, the tendency to exuberance and reprotrusion should be repressed by dressing with the mercurial ointment, with strapping.

If nearly the whole organ be protruded, or the portion left by excision be found diseased; it will be better to have recourse to castration. The remnant portion of testicle would be of no functional use, and would slough away, prolonging the cure.

**TUMOURS.**—The testicle, like other organs, is liable to be the seat of various morbid growths, forming Tumours; all of which are distinct in their nature from Chronic Enlargement or Sarcocoele, as resulting from any kind of morbid deposit,—Syphilitic, Scrofulous, or Tuberculous.

Tumours of the Testicle, thus pathologically distinguished, may be; Cystic; occasionally, Cartilaginous, and Fibrous; or Cancer,—Encephaloid and Scirrhus. These various testicular Tumours are sometimes described as additional forms of Sarcocoele, a misleading designation respecting their real nature.

**CYSTIC TUMOUR OF THE TESTICLE.**—This form of Tumour, known also as the Hydatid Testis of Sir A. Cooper, may be purely Cystic; or associated with Cartilaginous, or with Cancer Growth.

Cystic Disease consists of an agglomeration of cysts, thin-walled, varying in size from a pin's head to a walnut, and their globular shape modified by mutual pressure. They are *simple* cysts; containing fluid,

thin and colourless, or viscid and blood-tinged or otherwise discoloured; or they become *proliferous*, bearing on their interior fibrous growths, of a pedunculated, and lobulated shape, which occupy and eventually distend the cysts. These intra-cystic growths have been found by Mr. Quekett to possess a cellular structure covered on the surface with cylindrical epithelium, and they may contain small, hard, spherical bodies like pearls, composed of concentric layers of condensed epithelium. Fibrous tissue, in variable quantity, is formed with, and intervenes between, the cysts. When constituting the chief element of the tumour, this has been named *fibro-cystic* tumour. Thus Mr. Paget describes the cystic growth, as essentially a fibrous, or fibrous and cartilaginous, tumour in the testicle, with more or less cyst-formation in its substance.

The growth is not generally diffused throughout the organ; it originates, and remains circumscribed in one part; and as the growth increases, the unaffected portion of the testicle is pressed aside or spread out over the tumour; so that the mass, which is usually spherical, can perhaps be shelled out, leaving a considerable part of the testicle healthy. Occasionally, gland tissue has been found dispersed to a certain amount, through the cystic tumour. The epididymis, at first unaffected, becomes flattened, compressed, and atrophied.

The primary situation, and mode of origin, of the cysts, are doubtful. They appear to originate in the substance of the organ; but whether in the tubular gland tissue, or in the connective tissue, is uncertain. And the mode of cyst origin may perhaps be, a dilatation of the seminal tubules, as Sir A. Cooper originally stated, and Mr. Curling seems to have confirmed; or the cysts may originate as independent formations. Respecting the probability of the former mode of origin, it is a remarkable fact that spermatozoa are never found in the cysts.

*Signs and Diagnosis.*—The testicle enlarges, acquires an oval or nearly spherical form, and slowly attains to a considerable size. Its weight is less than that of any solid tumour, but it is heavier than hydrocele. Elasticity, over a limited area, with less decided fluctuation, and a total absence of transparency; will chiefly distinguish cystic testicle from hydrocele. The painless character of the tumour, and absence of constitutional symptoms, with the slow rate of growth; may determine the diagnosis as with regard to encephaloid cancer of the testicle. But the distinction between cystic-growth and non-transparent hydrocele, hæmatocele, and cancer, cannot sometimes be arrived at with certainty except by the aid of puncture to examine the nature of the fluid yielded, and at several points of the tumour. Cystic-testicle is most frequent between twenty and fifty.

*Treatment.*—Castration is the only cure; and it may be resorted to at an early period, especially when the other testicle is healthy and functionally efficient. As in the case of other double organs, the remaining testicle will probably acquire the power of doing double duty. The disease never returns, a therapeutically important distinction as compared with Cancer.

*Cartilaginous-Growth or Enchondroma*, is often associated with Cystic Tumour. The cartilage usually exists in the form of nodules, which apparently grow from and occupy the interior of the cysts; as a cartilaginous variety of proliferous cysts. These nodules are sometimes strung together into lines; apparently indicating that the cysts had formed by sacculated dilatations of the seminal tubes of the testis or its rete, in accordance with Curling's interpretation of cystic testicle. The cartilaginous structure may undergo calcification or ossification.



This structural admixture of cartilage, or of its transformation, with cysts, modifies the *signs* of cystic tumour of the testicle; by giving hardness and weight to the mass. But any such complication in no way contra-indicates the treatment by castration, nor affects the success of its result.

*Cancer-Growth* is not unfrequently associated with Cystic Tumour; this growth also taking place from the interior of the cysts, as a cancerous variety of proliferous cysts. The kind of cancer is encephaloid, and it forms in some parts of the tumour, leaving the remainder simply cystic; but ultimately perhaps invading the whole mass.

The *signs* of cystic testicle are modified accordingly; and although the treatment must still be castration, yet the result of the operation, as to a return of the disease, will be uncertain.

FIBROUS TUMOUR OF THE TESTICLE, is generally enumerated among the Tumours to which this organ is liable. An apparently well-marked specimen is described by Cruveilhier. Its consistence was very firm, and it creaked under the scalpel; the weight of the tumour was heavy in comparison with its size, which was twice that of the natural size of the testicle. In point of structure, when examined, it was found to consist of contorted and interlaced greyish-white fibres forming lobules, with vessels penetrating their interspaces; thus certainly confirming the nature of this tumour. Sir B. Brodie describes a less well-marked specimen, which he removed by castration. Mr. Paget speaks of a "fibro-cellular tumour," removed in like manner, by Mr. John Lawrence; and which was so succulent, that, in its consistence, it resembled a fatty tumour.

CARTILAGINOUS TUMOUR OF THE TESTICLE is sufficiently noticed in connexion with Cystic Tumour. These two forms of growth are so very frequently associated in the same Tumour, that the pathology and treatment of Enchondroma of the Testicle, as an independent form of Tumour, need not be considered separately.

CANCER OF THE TESTICLE usually occurs in the form of *encephaloid*, or occasionally its melanotic variety; rarely in the form of *scirrhus*.

*Encephaloid* cancer commences most frequently in the glandular portion, as small masses among the tubuli seminiferi; and these increasing, coalesce, to the destruction of the glandular substance. Less frequently, it begins at one point in the centre of the testis, or in the rete; and occasionally in the epididymis. From either of these sources, the growth invades the whole organ, reducing it to a cancerous mass, without any trace of the natural structure.

The encephaloid mass has, as usual in this species of cancer, a soft pulpy consistence, and commonly a more or less uniform white or pinkish-white colour. As the proportion of cancer-cells, or of the containing filamentous areolar stroma, predominates; so is the cancer substance developed, or the mass assumes the characters of a fibrous tumour. Or, the cancer-tumour may be associated with cyst formation, or with cartilaginous structure, in its substance. Thus, then, all the forms of morbid growth to which the testicle is liable, may be associated in one and the same Tumour. Hæmorrhage is apt to occur in the substance of Encephaloid Testicle, from any slight blow or external injury; and the blood may be effused interstitially, or into irregular cavities produced by its pressure. As the cancerous testicle increases, with a tolerably steady, but on the whole, rapid progress, it attains to a large size; the tunica albuginea yielding under pressure to a very great extent without rupture.

At length it bursts, and the mass protrudes as a bleeding fungus through the ulcerated skin. The disease extends along the cord to the abdomen, and the lumbar glands become involved; secondary cancer also being developed in other organs. Death ensues; usually, in about eighteen months or two years.

*Signs.*—Enlargement of the testicle, as a solid heavy tumour, of rapid growth, is the almost infallible indication of Encephaloid cancer. The unbroken tunica albuginea gives a hardness uniformly over the tumour, and a smoothness of surface, which really does not belong to encephaloid cancer; and which ceases subsequently, as the mass softens at parts into an elastic, pulpy, semi-fluctuating tumour, or when the tunic is ruptured and the mass protrudes. There is commonly little tenderness, or pain; or if there be, it is dull, not acute or lancinating. When the cord has become involved, it is enlarged, and feels thickened and full; so that the vas deferens cannot be distinguished. Shooting pains extend along the cord to the groin and loins. As the disease advances, constitutional symptoms are evinced by cachexia, and a breaking down of the general health; the patient having been at an early period of the disease, often in a robust, fleshy, and florid condition of health. The age when cancer of the testicle most commonly occurs, is from twenty to forty; it is rare after sixty, but it may occur at any period of life, from the earliest infancy to old age.

*Diagnosis* from other tumours of the testicle is mainly determined by the solidity and weight of Cancer-Tumour, with its rapid growth; but it must be distinguished from acute orchitis, and from chronic enlargement of the testicle,—syphilitic or scrofulous. The symptoms of inflammation, or the constitutional condition, respectively exclude these *Swellings* of the testicle from the question of diagnosis; and the various forms of Tumour are severally excluded by reference to the above-named characters. Thus, Cancer-Tumour of the testicle differs from *Cystic* Tumour in all these particulars,—its solidity, weight, and rapidity of growth; from *Fibrous* Tumour, if such should occur, it differs in the far greater rapidity of growth; and from *Cartilaginous* Tumour, the difference in this respect is equally significant. As compared with *non-transparent Hydrocele*, and with *Hæmatocele*, respectively; the solidity and weight of Cancer-Tumour are equally distinctive. But often the diagnosis can be accurately determined only by puncture of the Tumour, in order to subject to microscopic examination, the substance or fluid from the mass, in question.

*Scirrhus*-cancer far less frequently affects the testicle; a few examples only of this form of the disease having been recorded.

The *signs*, as distinguished from encephaloid cancer, are; greater solidity, hardness, and weight of the testicle, but the tumour is not disposed to attain so large a size. It is characterized also by slow growth, and the disease occurs at a later period of life.

*Treatment of Cancer of the Testicle.*—Castration is the only cure; provided that the whole of the disease can be thus removed. Consequently, when the disease is entirely local, affecting only the testicle; castration may be performed, and with an equal chance of success, as after similar operations for cancer in other parts. When, however, the spermatic cord is involved, and perhaps also the lumbar glands, presenting a tumour more or less perceptible in the abdomen; castration will be unjustifiable.

The *results* of the operation have been unsatisfactory both in the localized and extended conditions of the disease. Thus, in the latter condition; of 36 cases collected in the Medical Times and Gazette (vol. xix.), 3 died within a week, and cancer was found in the lumbar glands; 2 died within six weeks; and 2 within three months of the operation. In each case, there was disease of the lumbar glands, or lungs, or both. When the disease, being local, has been completely extirpated, the tendency to secondary cancer, particularly in the lungs, is remarkably strong; and life may be prolonged only by a short period. One patient, under Professor Humphry's observation, lived four years, and died, as was believed, of phthisis. But a similar period of existence, in another case, was known to Sir B. Brodie, and the patient then remained well. Mr. Curling also relates four cases in which the patients were well at the respective periods of 10, 4, 9, and 12 years, after the operation. On the other hand, without operation; in 2 of the above-mentioned 36 cases, the disease terminated fatally in a period of four months from the time it was first observed in the testicle; but cases have been recorded in which life continued for 5, and even 15, years!

CASTRATION.—Removal of the testicle is a very simple operation, but certain practical directions of importance should be observed. The pubes having been shaved on the side of operation, the patient should be drawn to the end of the table; so that resting there on his buttocks, the thighs and legs shall hang down, and give fair room for handling the tumour. The surgeon standing in front, between the patient's legs, grasps the tumour posteriorly with his left hand, making the scrotum tense in front. Then, a bistoury is entered opposite the external abdominal ring, in order to reach the cord sufficiently high up that when it comes to be divided, the cut stump, which is apt to retract, shall be freely accessible for ligature of the vessels. On this account, it may sometimes be advantageous to expose and isolate the cord, before removing the testicle from the scrotum. The incision is carried down longitudinally, from the external ring, over the anterior surface of the tumour to the bottom of the scrotum; or if the mass be of very large size, or the skin affected, a double elliptical incision may be made enclosing a portion of the scrotum; it will seldom be requisite to remove any apparent redundancy of healthy integument, as the scrotal skin contracts and shrivels up very considerably after the operation. The tumour is readily turned out of the scrotum by a few touches with the knife, dividing its loose cellular connexions; on the inner side, the knife should be particularly turned outwards, towards the tumour, in order to avoid puncturing the urethra, or opening the tunica vaginalis of the opposite side. Having detached the testicle and isolated the cord, the latter is seized between the thumb and finger by an assistant, or with a vulsellum, and held in position. The cord is then divided by a stroke of the knife below this point, and the testicle completely removed. The spermatic artery, and probably two or three cremasteric branches, will require ligature. This mode of securing the vessels is preferable to tying the whole cord, a practice adopted by some surgeons. But if there be any fear of retraction of the cord through the ring into the inguinal canal, it should be ligatured and retained in position by a strip of plaster over the ends of the thread. Scrotal vessels generally cease to bleed by sponging with cold water. Sutures are not required, the edges of the scrotal integument falling into apposition; and



the wound, being dressed with a strip of wet lint, heals by granulation from the bottom.

In the after-dressing, bagging in the lower part of the scrotum must be prevented. Secondary hæmorrhage may necessitate a reopening of the scrotum, which must then be lightly stuffed with wet lint. Retraction of the cord into the inguinal canal, would render it very difficult to follow up the source of hæmorrhage in that situation; and a serious or even fatal loss of blood might ensue, by its escape into the cellular texture of the groin and pelvis, without much external hæmorrhage.

ATROPHY OF THE TESTICLE may occur as the result of various structural conditions, which have already been described. *Hydrocele* is an occasional cause, by pressure of the fluid in the tunica vaginalis; and sometimes in consequence of the contraction of lymph effused in chronic hydrocele, or more frequently in *Hæmatocele*. *Diseases* of the testicle, also, result in absorption of the glandular substance; somewhat in proportion to the extent and persistence of any morbid deposit, or the formation of new growths, within the testis. Thus, atrophy may ensue from orchitis, acute or chronic; and more especially in the chronic form, with syphilitic intertubular deposit, or with scrofulous intertubular deposit. Obliteration of the *vas deferens* from inflammation, or from pressure by constantly wearing a truss, has been known to induce atrophy of the testis; although the function of the organ may be thereby long suspended or lost without this result. *Varicocele* is an occasional cause, and obliteration of the spermatic veins by *operations* for the cure of this condition. Elephantiasis of the scrotum may be mentioned, as having the same effect. *Functional excitement of the organ*, from excessive venery, or from self-abuse, has an atrophying influence; and *injury* of the back of the head, a similar tendency, apparently by affecting the cerebellum. In *elderly persons*, the testes are rather small and flaccid, but otherwise healthy; and the epididymis is sometimes thickened and indurated, with a similar state of the vasa deferentia, and opaque white spots in their walls.

No particular *Treatment* can be directed for a condition, the causes of which are so diversified and often irremovable.

FUNCTIONAL DISORDERS OF THE TESTICLE, are associated with Functional Disorders of the whole Generative Apparatus, constituting Spermatorrhœa and Impotence.

*Spermatorrhœa*, or Seminal Emissions, easily excited and oft recurring. This disorder may occur; either, as *passive* discharges of seminal fluid, without much, if any, ejaculation or even previous erection, or, as emissions, with *spasmodic* ejaculation and perhaps erection. In the one form of the disorder, seminal discharge takes place before erection; in the other, erection and ejaculation are often simultaneous acts, or erection may subside before ejaculation. In both conditions therefore, connexion is impracticable; and thus there is loss of sexual power, and apparently, at least, of procreative power.

*Passive Spermatorrhœa* denotes an excitability of the testes as secretory organs, whereby an excessive secretion or flux of seminal fluid is easily provoked, usually of a thin spurious character; and accompanied with irritability of the ejaculatory muscles, and of the erector muscles of the penis; while the constitutional condition is one of general debility.

The common *cause* of this state of mixed generative irritability and constitutional debility, is habitual masturbation or self-abuse. This

pernicious habit is acquired often at an early age, before puberty, by evil example or conversation among boys, who are intimately associated in Schools and other Institutions. A practice thus engendered, before moral control has yet been developed, and indulged in ignorance of its sad consequences, may be rectified only perhaps by marriage, or perhaps continued until it has wrecked its victim,—physically, intellectually, and morally. Spermatorrhœa is less frequently the consequence of suppressed sexual desire. It seems also more common in the upper and middle, than in the lower ranks of life, regarded socially; and among the educated and studious, than among those who have early followed some bodily avocation, or have been accustomed to the healthful games and outdoor pastimes of youth.

At first, seminal emissions happen only occasionally; once a fortnight or in a week, and usually in the morning between sleeping and waking, or as nocturnal emissions. After a while they become more frequent, perhaps three or four times a week, and occur during the day; under any slight emotional excitement, a word or even a look; or from some slight irritation, as by the movement of a carriage, or by any straining exertion, especially at stool. Ultimately, the emissions occur every twenty-four hours, and sometimes twice or thrice daily; the semen flowing back into the neck of the bladder, and escaping with each act of micturition or defæcation.

The physical consequences of spermatorrhœa, are evinced by general debility, and disorder of the various functions; indigestion, palpitation of the heart, breathlessness, nervousness, epileptic, and amaurotic symptoms, or even paralysis. The intellectual and moral decay are manifested by a general impairment of mental vigour; especially, inability to fix the attention, and loss of memory; and by loss of moral courage, great depression of spirits and despondency or despair, shyness, reserve, and solitariness. Altogether, the pallid, vacant-looking, dejected, and lonely, victim of spermatorrhœa, in its advanced stage, is a wretched spectacle which can scarcely be mistaken. He is often made worse, and his mental sufferings are aggravated, by reading some of the abominable and lying publications of quacks and extortionists; he is thus also entrapped into their dens, where his worst fears are speedily confirmed by personal influence, and his pecuniary resources drained to the last shilling, or incredible sums abstracted for promised cure. In one such case of imposition, a gentleman came to me for relief, whose penis was strangulated at the root by means of a broad metallic ring, furnished with a screw which tightly compressed a plate of metal on the urethra; the whole contrivance forming a vice in which his penis had been placed by one of the daily-advertising impostors, and which he had been ordered to wear for the ostensible purpose of stopping seminal emissions. Of course, the pain of approaching strangulation daily increasing, daily compelled the patient to visit his merciless torturer; and when the poor victim came to me, his penis had become swollen to the size of a Saveloy-sausage, burying the vice, and the integument was rapidly passing into gangrene. I removed this instrument of torture, only just in time to save the organ.

*Spasmodic Spermatorrhœa* differs only from the more passive form of seminal emissions; in the increased irritability of the ejaculatory and erector muscles of the penis, and of the prostatic portion of the urethra where the ejaculatory ducts open. It is not unfrequently co-existent with some disease of the generative organs,—stricture, varicocele, or neu-

ralgia of the testicle, which may be the source of local irritation. Residence in a hot climate seems to have some predisposing influence; and the affection occurs usually at a later period of life than passive emissions in men, from the ages of twenty-five to forty.

*Treatment.*—The removal, if possible, of any source of *irritation*, is the primary indication. Thence, the habit of masturbation must be corrected, whenever its practice can be discovered; and the patient should be encouraged to make a confidential acknowledgment respecting a matter of such vital consequence to his health and happiness. The influence of evil example should also be withdrawn, in youth; and the mind of an adult patient may have to be disabused of the groundless apprehensions which have been instilled into it by some rapacious impostor. Any source of local irritation, as a cause of spermatorrhœa, must be removed, when practicable.

*Remedial treatment* comprises both constitutional and local measures. *Constitutional treatment* consists in the administration of tonics to restore a healthy state of both the muscular and nervous systems, and in the use of sedatives to allay irritability. Of tonics, the preparations of iron are most efficacious; and particularly, the sesquichloride of iron, in doses of from 15 to 30 drops in half a wine-glassful of water, thrice daily. Strychnia, in doses of the  $\frac{1}{12}$  of a grain, made into a pill, with or without the sulphate of iron; forms a tonic anti-spasmodic preparation of great value. Sedatives are less beneficial than tonics; yet in spasmodic spermatorrhœa, a night-pill of belladonna, or of hyoscyamus and camphor, may perhaps be advantageously given to subdue the local irritability which favours the seminal emissions. Suppositories of pil. saponis, 10grs., are, according to my experience, preferable as acting topically. The cold hip-bath, or sluicing the perineum with cold water, night and

FIG. 468.



morning, is a most serviceable local tonic. *Hygienic measures* must also be carefully attended to, as a part of the constitutional treatment. A plain, unstimulating, nutritious diet, is essentially requisite; rigorously excluding peppers and other condiments, which are apt to irritate the rectum and provoke seminal emissions during defæcation. The stomach should never be overloaded by a heavy meal; and a daily action of the bowels should be secured by gentle aperients, when necessary. A dinner-pill, consisting of the compound rhubarb-pill with hyoscyamus, will answer this purpose far better than colocynth or any other irritant purgative. The invigorating influence of daily exercise in the open air, and of out-door amusements, with perhaps recourse to a bracing climate, can scarcely be overlooked; but relaxation from study or the excitement of business, and freedom if possible from the pressure of anxiety, are no less restorative; while every encouragement must be given to cheerfulness and hope.

All this constitutional treatment not unfrequently fails to cure the spermatorrhœa; the local irritability of the prostatic urethra still remaining. Recourse must be had to the application of nitrate of silver along the under surface of this portion of the urethra, to the orifices of the ejaculatory ducts.



This method of treatment, first prominently brought into notice by Lallemand, can be effected by means of the *porte-caustique* (Fig. 468), or by a *syringe-catheter*. The former instrument is also a kind of catheter, but which acts by protruding its end, carrying the caustic. This portion, however, is apt to be grasped by spasmodic muscular action, and can then be returned only with difficulty into the shaft; or it may perhaps become fixed in the prostatic urethra, owing to some defect in the instrument, as happened in the person of a gentleman on whom Dr. Humphry was operating. In the syringe-catheter, a piece of sponge charged with a solution of the caustic, is compressed by pushing down a firm stylet within the catheter; whereby the solution is forced out of about a dozen minute apertures near the end of the instrument. This mode of applying the caustic has the advantage of being safer and more manageable than by the *porte-caustique*. It is highly commended by Mr. Erichsen, who uses a solution of the strength generally, of one drachm of the nitrate to an ounce of water. In applying either of these instruments, the prostatic urethra is known to be reached; by the distance to which the shaft has passed, and by feeling with the finger in the rectum, also by the sensitiveness of the part. Considerable irritation, pain, and bloody or mucopurulent discharge, follow the operation; with perhaps an aggravation of the nocturnal emissions. These subsiding in a few days, the cure may be complete; or the caustic may have to be re-applied when the urethra can bear it, at intervals of a week or two; and sometimes no good results from the treatment.

*Impotence* signifies an absence, loss, or premature decay, of sexual and procreative power; with generally a corresponding negation of sexual desire. The seminal secretion may be absent; a condition known as *Asperma*, and which contrasts with that of Seminal Flux. But as in that condition, any slight secretion is often thin and spurious; not containing spermatozoa or only in scanty quantity.

It is highly important not to mistake the nature of the *prostatic* secretion; which may be discharged from the urethra as a tenacious fluid, like white-of-egg, in small quantity, and following the urine, or expelled during defæcation, especially when accompanied by a straining effort. Such discharge is quite consistent with an absence of *Spermatorrhœa*,—the presence of impotence.

The *cause* of impotence may be some congenital, or acquired, deficiency, of, or affecting, the genital organs.

*Congenital* impotency is sometimes a cerebral imperfection, as occurring in idiots; or from a want of that concurrence of forces which is requisite for the complicated process of generation. This constitutional impotence is not necessarily associated with any discoverable imperfection in the organs, or any obvious defect of bodily formation. It may, indeed, be associated with full intellectual vigour; and with a physique endowed with great muscular power, developed also by athletic exercises. But more often, the external indications of virility are defective when sexual power is wanting.

*Acquired* impotence may be the result of prolonged sexual excesses, or of habitual physical exertion; in either way exhausting the nervous energy. Occasionally, it follows injuries of the head, and usually when the patient is convalescent. Wasting of the testicles may be the first announcement of generative failure; and this may be persistent, or the sexual power gradually returns.

The *Treatment* of Impotence must have reference to its various causative conditions ; consequently, it is often incurable.

NEURALGIA OF THE TESTICLE.—This affection of the testis, resembles neuralgia as occurring in other parts. The pain varies in character and severity ; being sometimes dull and aching, or darting and so acute as to make the patient roll on the floor in sweating agony. Often the pain is paroxysmal.

Various causes, local and constitutional, may give rise to this suffering ; any source of irritation in an adjacent organ, as stone in the bladder, kidney or ureter ; or disease of any part of the urinary apparatus ; varicocele ; gastric or hepatic irritation ; or it may arise from a depressed state of the general health, especially as the consequence of malarious influence, and then the pain usually recurs periodically. The testicle itself is generally healthy in its structure.

*Treatment* of a curative character implies the discovery and removal of the cause in operation, and these requisites cannot always be fulfilled. Tonics, especially quinine and iron, are remedial ; particularly in the periodic form of the neuralgic affection. The hypodermic, or perhaps the testicular, injection of morphia, might be worthy of trial.

Ought castration ever to be performed as a last resource to relieve pain, or in compliance with the urgent request of the patient ? The question is a serious one, inasmuch as it relates to the removal of an organ, not structurally diseased and important in itself ; and which may almost at any moment cease to afflict the patient. But this question should be considered, with reference to the probability of removing the cause of neuralgia, persistence of this painful affection undermining the general health, and with regard to the urgency of the patient's request when the nature of the case is explained to him, in an intermission of pain. Sir A. Cooper was induced by the latter consideration to perform castration in three cases of the kind ; and other Surgeons have deemed it advisable to do the same. Yet the operation is justifiable only in rare and exceptional cases.

MAL-POSITION OF THE TESTICLE.—In the fœtus, the testes are contained within the abdomen, in the lumbar region ; whence they gradually descend through the inguinal canal into the scrotum, a change of situation which is usually completed before birth. But, by an arrest of development, this descent of the testis may be retarded until after birth, and it may then never take place completely. The descent of this organ is delayed till a few months, or a year, after birth, in about 1 infant in 5. It occurred at a later period in many cases which came under Sir A. Cooper's observation ; the testis descending at from one to seventeen years, or even twenty-one years. Complete descent fails to take place in about 1 person in 1000 ; and then the testis may be permanently retained in the abdominal cavity, or in the internal abdominal ring, or in the inguinal canal just above the external abdominal ring. The right or the left testis is nearly equally liable to these mal-positions ; and rarely it happens with both testicles.

The causes of any such failure of descent would seem to be a deficiency in the force, whether it be the contraction of the fibres of the gubernaculum or some other force, whereby the descent of the organ is effected ; or sometimes, an impediment to the process ; as an imperfect development of the mesorchium, or adhesion to one of the viscera or to the abdominal wall, consequent on intra-uterine peritonitis ; imperfect patency of one of

the inguinal rings, or some obstacle in the inguinal canal. Shortness of the vas deferens or of the spermatic vessels, may also be regarded as a cause of retention ; though the cord is often tortuous or convoluted.

The condition of the retained testis, as to its *structure* and *function*, is variable. It has been found of full size, rarely ; generally, it is imperfectly developed, being smaller than natural, and its gland-tissue remaining immature as in the infantile organ. Or, it may be atrophied, and have undergone fibrous or fatty degeneration, obliterating any trace of gland-structure. Functionally, the organ is incompetent. This want of secretory power for the production of spermatozoa, is of little consequence when the other testicle has descended and is healthy ; the one organ being quite sufficient for generation. But when both organs are retained, the procreative power will usually be completely wanting ; the individual is absolutely impotent. He may have full sexual desire, power of erection, and emissions during connexion ; but the spurious seminal fluid contains no spermatozoa, and has no impregnating influence.

*Diseases of retained testicle.*—The organ is liable to *inflammation*, and to *malignant disease* ; and orchitis is especially liable to occur when the testis is lodged in the inguinal canal, the inflammation arising from gonorrhœa or from injury. The diagnosis between a retained testis in that situation, and inguinal hernia, or even bubo, must be determined by reference to the symptoms of these conditions. Mistakes have been made by eminent Surgeons, and Ricord nearly mistook an inflamed testis for a bubo. *Congenital hernia* not unfrequently accompanies and complicates undescended testis in the inguinal canal. The testis may be unable to bear the pressure of the truss requisite to prevent the descent of the hernia ; while in an operation some difficulty is often experienced, owing to adhesion of the gland and bowel.

*Mis-descent* of the testicle has been known to occur ; the organ descending and escaping into the perineum near the anus, or into the pelvis ; or through the crural ring and saphenous opening, thence upwards upon the abdomen, and simulating crural hernia, or lodging behind the fascia in the upper and inner part of the thigh.

*Inversion* of an undescended testis is occasionally met with ; the vas deferens and epididymis presenting forwards, and the body of the organ looking backwards. The diagnosis of any diseased condition is then rendered more difficult. If hydrocele co-exists, the fluid swelling will be situated behind the testicle.

#### DISEASES OF THE VESICULÆ SEMINALES.

These two oblong, sacculated receptacles for semen lie at the base of the bladder, and converge from behind forwards to the base of the prostate ; the vasa deferentia come forwards between them to that gland, and each vas there joins with the opening of the corresponding seminal vesicle, to form the common ejaculatory ducts. Thus situated, and connected, the seminal vesicles are not uncommonly diseased in company with the testicles, or sometimes independently of those organs ; and these diseases may induce or aggravate disease of the bladder, and less frequently, of the rectum.

The seminal vesicles are subject to *inflammation*, arising independently or in consequence of gonorrhœa ; and they are liable to *chronic* enlargement, especially of a scrofulous character ; and to *malignant* disease.

*Diagnosis* is much facilitated by the situation of these bodies, as they lie within reach of the finger passed into the rectum.

*Treatment* must be conducted on ordinary principles.



## CHAPTER LXIII.

## INJURIES AND DISEASES OF THE FEMALE GENITAL ORGANS.

A LIMITED notice only can be taken of some of the Diseases which affecting, or specially pertaining to, the Female Genital Organs, come under the observation of the general Surgeon; and principally with regard to the operative procedures requisite for their cure.

These *Diseases* relate to; (1) the External Organs, or the *Vulva*, in its several parts, and the *Vagina*; with which may be conveniently associated, the *Perineum*; (2) the *Uterus*, and Fallopian Tubes; (3) the *Ovaries*.

The External Organs are also liable to *Injuries*; in the form of Wounds of the Vulva, or of the Vagina, and Laceration of the Perineum; or the introduction of Foreign Bodies.

(1) EXTERNAL ORGANS.—WOUNDS OF THE VULVA, present nothing peculiar, excepting the proneness to copious hæmorrhage, owing to the natural vascularity of the labia, nymphæ, and clitoris. But the tendency to primary union is remarkable. The treatment, therefore, is by suture and simple dressing.

Wounds of the *Vagina* are even more rare than of the vulva. In Mr. Erichsen's practice, a remarkable case happened; a cedar pencil, five inches long and cut to a point, had been forced up through the posterior wall of the vagina of a young woman into the abdominal cavity, and there it transfixed two coils of the small intestine. After a sojourn of eight months, it was extracted by an incision through the anterior abdominal wall, midway between the umbilicus and Poupart's ligament, where its point was engaged in the fascia transversalis. It had occasioned repeated attacks of peritonitis, and after its extraction, death resulted from that cause.

LACERATION OF THE PERINEUM.—This injury happens occasionally during parturition; in consequence of the large size of the fœtal head, or from rigidity of the perineum; or sometimes, by what, I believe, may be fairly designated the unskilful use of the hand in the vagina, or of instruments. During parturition, laceration or rupture of the perineum occurs in the passage of the fœtal head. It varies considerably in its extent and consequence. Perineal laceration may be regarded as of four degrees; that which is limited to the anterior edge of the perineum; that which extends backwards through the whole length of the perineum to the sphincter ani; or perhaps, involving this muscle; and occasionally extending into the recto-vaginal septum. A combination of laceration and sloughing is sometimes met with; the perineum being torn through, and the recto-vaginal septum destroyed by sloughing, from prolonged impaction of the fœtal head. The fissure, directly resulting from laceration and increased by loss of the septal substance, may be complicated also by the subsequent formation of dense bands of imperfect cicatrix; thus presenting the most difficult form of lesion in regard to treatment.

The *consequences* of laceration depend upon its extent. Whenever it passes beyond the anterior margin of the perineum, and especially when it involves the sphincter ani and perhaps the septum; there will be a

tendency to prolapsus of the uterus and bladder, of the rectal mucous membrane, or of all these parts; and with the latter condition, as depending on the sphincter having given way, there will also be inability to retain the *fæces*,—incontinence of *fæces*.

*Treatment*.—Operative interference is absolutely necessary in all degrees of perineal laceration, except that of a slight rent in the front margin of the perineum. This will, generally, heal by rest, and cleanliness, with perhaps an occasional touch with nitrate of silver.

The *operation* in each of the other degrees of further laceration, is essentially the same; a plastic procedure, which consists in freely paring the edges of the fissure, and bringing them together by quilled sutures, to procure union by adhesion. *Prior* to operation, the patient's general health should be brought into the best possible state, and any source of local irritation removed; as these two conditions will mainly determine a successful result. The operation is then performed as follows.—The bowels having been thoroughly emptied, chloroform is administered, and the patient placed in a lithotomy position; a duck-billed speculum is passed into the vagina, so as to elevate the upper floor, and thoroughly expose the perineal fissure. This must then be freely pared throughout its depth and extent, on either side; thus to prepare two raw surfaces, together of nearly a horse-shoe shape. The width of the raw surface averages about an inch. Unless the surface be thoroughly pared, so as to form a good thick cushion instead of only a thin cutaneous support, the tendency to prolapsus will continue; and any point of undenuded surface will probably be followed by the establishment of a fistulous opening. Hemorrhage is often rather free, and the fissure should not be brought together until this has ceased. Ice is the best styptic. Division of the sphincter ani, on each side of the coccyx, is recommended by Mr. Baker Brown, in order that its action shall be paralysed and all tension of the part be overcome. This additional feature in the operation is necessary, or at least advisable, when the laceration passes high up into the recto-vaginal septum. The parts having ceased to bleed, and coming freely together into *easy* apposition; the quilled sutures are applied at as many points as may be necessary to bring the surfaces into one line of union. For this purpose, two pieces of bougie may be used; or two quills, rods of glass, or perforated metal bars. Fine whipcord is the best material for the sutures. By the thickness of the raw surfaces, and the firm support of the lateral rods, the superficial edges of the fissure are often seen to be everted. In concluding the operation, therefore, it may be advisable to bring the *edges* together with a few points of ordinary interrupted suture; using metallic wire in preference to fine silk.

*After-treatment* is very important. It consists in preventing any intestinal action for ten or twelve days, by keeping the patient sufficiently under the influence of opium; and averting any dribbling of urine over the raw edges, by retaining a catheter in the bladder, furnished with a long india-rubber tube to carry off the urine free of the person. Scrupulous cleanliness of the parts is absolutely necessary. The strength must be maintained by abundant fluid nourishment. The sutures should not be removed for a week; and rest in the recumbent posture be still continued for two or three weeks longer lest the recently united parts might yield.

Prolapsus, when effectually cured by the operation, is previously much ameliorated by this prolonged recumbency; the turgid and ulcerated os-

uteri recovers a healthy state, and the relaxed uterine ligaments have time to regain their tension.

The *results* of this operation require further investigation. But, the extent of laceration, and sometimes loss of substance, materially affect the issue. When the laceration involves the sphincter ani, and is consequently attended with incontinence of feces; an operation for the restoration of the perineum will effectually afford the support necessary for control over defæcation. But the lesser evil consequence of such laceration—prolapsus, will be less certainly remedied. It may be cured temporarily, the prolapsus subsequently returning. In 10 cases on which Mr. Jonathan Hutchinson operated; two or three of the patients continued to suffer from prolapsus, although in a lesser degree; three remained permanently cured. In one of these successful results, the patient was an elderly woman, and who had suffered from most distressing prolapsus. *Failures* of the operation sometimes occur; more often as the result of extensive laceration, and perhaps loss of substance. No union was obtained in one of Mr. Hutchinson's cases. I have also experienced in one case, partial non-union. Recto-vaginal fistula is an occasional result, principally from incompleteness of the operation itself.

FOREIGN BODIES IN THE VAGINA.—Various kinds of foreign bodies may be introduced into the vagina; accidentally, or intentionally, and in the latter case occasionally, with malicious intent. Thus, by a fall, the spike of an iron railing has been known to enter the vagina; in the Museum of the Royal College of Surgeons, there is a glass tumbler which a woman had thrust into her vagina, for some purpose best known to herself; and I have extracted a piece of swollen sponge from the os uteri, which a young woman had passed up her vagina, with the view of preventing the liability to conception from sexual intercourse.

• The danger arising from the introduction of foreign bodies into the vagina, will depend upon their nature, the amount of damage done, and the period of impaction. A hard, rough body, forcibly thrust up the passage, is often productive of copious *hæmorrhage*, especially by laceration of the labia externally. A pointed body, may *perforate* the vagina, as in Mr. Erichsen's case of punctured wound already mentioned. The continued impaction of a foreign body gives rise to *vaginitis* and discharge, requiring appropriate treatment, even when the substance has been removed.

DISEASES OF THE EXTERNAL GENITALS.—HYPERTROPHY OF THE LABIA, OR OF THE CLITORIS.—These parts are liable to enlargement, of a fibro-cellular character; sometimes forming an apparently distinct outgrowth. This hypertrophy, or tumour, seems to be the result of prolonged irritation, in connexion with some fissure of the part, or from morbid vaginal discharge. A fibro-cellular out-growth of the clitoris, which had attained to the size of a very large cocoa-nut and weighed thirty ounces, was removed by Dr. A. Marsden at the Royal Free Hospital. I gave a short description of the growth in *The Lancet*, August, 1857.

*Excision* is the only remedy for these conditions. *Hæmorrhage* is often profuse, the blood coming from a number of small vessels. A good precaution, therefore, is to transfix the base of the mass by means of hare-lip pins and twisted sutures, before using the knife.

CONDYLOMATA OR VERRUCÆ are of common occurrence, in consequence of prolonged irritation from syphilitic or gonorrhœal discharge, and uncleanness. A large cauliflower mass is at length formed. Its removal can



sometimes be effected, like warts of the prepuce in males, by dusting the part with a powder consisting of equal proportions of pulverized savine and copper. Excision, however, must generally be resorted to when the mass is considerable; and this is accomplished most readily with scissors curved on the flat.

*Abscess of the labium* occurs, not unfrequently, in consequence of some injury to the part in sexual intercourse. It is most liable to happen soon after marriage, when the parts are as yet unaccustomed to attrition; and in prostitutes, from the contingencies of promiscuous intercourse. The abscess seems to arise by rupture of one of the veins in the labium; and when it bursts on the inner side, after the lapse of perhaps only a few days, or is laid open by incision, it discharges a mixture of venous blood and fetid pus.

CYSTIC TUMOURS, are occasionally met with in the subcutaneous cellular tissue of the external genitals. They occur in two situations; either about an inch and a half within the vulva, a little below the middle of one or other side of the vagina, and as the result of enlargement of Cowper's glands; or, in the cellular texture of the labia, where the cyst attains to a larger size—that of a chestnut or even a small orange, and resulting from the enlargement of a mucous follicle. In both situations, the cysts contain a glairy fluid, perhaps tinged with blood from any slight injury of the part.

*Diagnosis.*—Cysts may be distinguished from *abscess*, by the absence of inflammatory symptoms, or of such symptoms in the history of origin. A cyst may become the seat of inflammation and be converted into an abscess. The diagnosis will then be most difficult or impossible, unless the patient's own evidence can be trusted as to the previously distinct formation of a cystic swelling. From *inguinal hernia* descending into the *labium*, a cyst is distinguished by its incompressibility, irreducibility, and the absence of impulse on coughing. Puncture of the swelling may of course be resorted to in any doubtful case, when the possibility of hernia is excluded from the diagnosis.

*Treatment.*—Obliteration of the cyst can not unfrequently be effected by a free incision, and the introduction of a strip of lint to provoke suppurative granulation from the bottom of the cavity. Excision is a more speedy cure; but the dissection, easy in itself, is somewhat embarrassed by the free hemorrhage from the vascular texture of the labium. This may be arrested by pressure with a compress and T bandage.

EPITHELIAL CANCER, is not very uncommon in the labia and vagina. It presents the same characters as in other parts. An irregular, undermined, indurated margin, an unhealthy gray surface, and a tendency to the production of warty granulations, are its most distinctive appearances. It may commence in, or extend into and up, the vagina; converting this passage into a hard, solid, open tube, having a tuberculated surface, of an ash-gray colour. This state of the vagina was well marked in a patient under my care at the Hospital. The inguinal glands speedily become infected. Middle-age is most predisposed to this affection.

*Treatment.*—The disease may be removed by excision, or by caustic; and any affected glands must also be extirpated. In the case just referred to, I freely cauterized the interior of the vagina with strong nitric acid, but only with temporary benefit. A speedy recurrence of the disease is the, perhaps, invariable result of any interference.

*Rodent ulcer* is very rarely met with on the female genitals. It may

be distinguished from epithelial cancer, by the absence of warty growth, by its slow progress, and by the freedom of the glands from infection.

This disease is amenable to excision.

**VASCULAR OR ERECTILE TUMOURS**, not uncommonly grow near, or just within, the meatus urinarius. Such tumours are broad-based or pedunculated, of small size, red and disposed to bleed, sensitive or painful. Pain in micturition, and in sexual intercourse, with occasional bleeding, may lead to an examination, and then the source of irritation is discovered.

*Treatment*.—Complete removal of the growth is the only cure, and this may be effected by excision with curved scissors, ligature, or cautery. The sub-mucous base must be removed with the growth; it will therefore be necessary to thoroughly expose the part for operation, and it may be desirable to place the patient under the influence of chloroform.

**CLOSURE OF THE LABIA, OR OF THE VAGINA**.—As the result of malformation, it not unfrequently happens, that the *Labia* are adherent, leaving perhaps a pin-hole opening for the trickling escape of urine. This defect is usually discovered in infancy, when the adhesion can be easily separated.

*Treatment* consists in simply running a probe between the labia, and then inserting a strip of oiled lint to prevent re-union. The cure is generally permanent; it was so in a recent case brought to me for relief.

Closure of the *Vagina*, as the result of malformation or sometimes of adhesive inflammation in early life, is a defect less apt to attract attention, and seldom discovered until the period of menstruation. Amenorrhœa then arising from accumulated retention of the menstrual secretion, this is attended with a sense of bearing-down weight in the perineum, which suggests the necessity for an examination.

*Treatment*, here also, consists, in opening the vagina, and tearing asunder the adherent walls with the finger or the handle of a scalpel; and then introducing a pledget of oiled lint, until the surfaces have healed separately.

*Imperforate Hymen* is another occasion of occluded vagina. This defect also will probably remain undiscovered until puberty. The accumulated retention of menstrual fluid at length causes distension and protrusion of the imperforate and thickened hymen beyond the vulva, with a bearing-down weight; while, an elastic fluctuating tumour can sometimes be felt above the pubes or in the iliac fossa.

*Treatment*.—An aperture must be made in the hymen; and this may be done by puncture with a trocar, and then enlarging the opening with a probe-pointed bistoury; or by making a free crucial incision. Complete removal of the hymen by dissection, has been recommended by Mr. Baker Brown: but this extreme procedure seems unnecessary for the functional freedom of the vagina, and indeed might be followed by cicatricial stricture. In either mode of freeing the passage, the urethra must be carefully avoided; a precaution less easily observed when “the hymen is removed entire by a circular incision.” An opening having been made, the retained menstrual fluid is discharged, often in a very large quantity and of a very offensive odour. The relief thus afforded is immediate. But the danger and fatality of this simple operative procedure is considerable. Peritonitis often ensues; not, of a puerperal or contagious character, as was formerly suggested by Dr Blundell and others; but apparently in consequence of some of the menstrual fluid finding its way

upwards through the free extremity of the Fallopian tube into the cavity of the peritoneum, or by rupture of the tube which, with the uterus, had previously undergone dilatation from retrogressive distension with the accumulated fluid. That these two events should occur after the relief of tension by operation, is remarkable; yet they seem to be established by the observations of Bernutz, Goupil, and Jonathan Hutchinson.

*Partial imperforate hymen* is occasionally met with. This condition, however, is no barrier to marriage, or to impregnation; or even to parturition, the hymen rupturing, usually, under pressure of the foetal head.

Incision will be desirable to free the patient from any unhappy matrimonial restraint.

**RECTAL AND VAGINAL FISTULÆ.**—Fistulous openings may exist in the Female Organs; between the rectum and vagina,—*Recto-Vaginal Fistula*; or between the bladder and vagina,—*Vesico-Vaginal Fistula*. These Fistulæ, and their modifications, have already been described, as thus designated, in previous parts of this work.

**PROLAPSUS VAGINÆ.**—A falling-down of the vagina is liable to occur; either in its anterior wall, with protrusion of the bladder, constituting *Cystocele*; or, in its posterior wall, forming *Rectocele*. These conditions present the characteristic appearance of the rugous walls of the vagina, and are thus distinguished from prolapsus of the uterus, in which the os uteri descends as the most prominent part of the protrusion. The sense of bearing-down, and constant vaginal discharge—with the vesical irritability in cystocele—usually compel the patient to seek relief.

*Treatment* may be palliative or curative. The *former* consists in returning the protrusion, and supporting it by the introduction of a properly-shaped pessary; the globular boxwood pessary being, I believe, most suitable. A much larger one can be conveniently worn than would seem requisite, owing to the relaxation and enlargement of the vagina above the entrance, as the consequence of prolapsus. *Curative* treatment consists in having recourse to a plastic operation; by paring off a strip of mucous membrane from below the meatus on one side round to the same point on the other side, and uniting the raw surfaces by suture. The width and length of the strip should vary according to the degree of prolapsus; the object being to sufficiently narrow the canal for the permanent support of the protrusion. As after other plastic procedures relating to these parts, the bowels should be confined by opium, and scrupulous attention paid to cleanliness; a catheter communicating with an india-rubber tube is retained in the bladder to carry off the urine.

**TUMOURS.**—The vagina may be the seat of tumours, springing from its walls. *Mucous polypi*, and *cystic* growths, are here met with. Their relations must be carefully made out before resorting to any operation. When the tumour grows from the posterior wall of the vagina, rectal examination will determine this question.

*Removal* of these tumours can be effected by excision or ligature.

(2) THE UTERUS is subject to various Displacements; and to the formation of Tumours, benign and malignant.

*Displacements* comprise: various alterations in the direction of the axis of the uterus,—*Anteversion*, *Retroversion*, *Latero-version*, right or left; corresponding forms of *Flexion* or bending of the uterus upon itself; and *Prolapsus*, which, when incomplete, is distinguished as *Procidentia*.



The *causes* of these displacements are mostly represented by any occasion of increased weight of the organ, so situated as to produce the particular form of displacement.

*Treatment* must be directed to the removal of whatever cause may be in operation. When the displacement is due to inflammatory turgescence, this cause will obviously be more capable of removal, than when it depends on some structural enlargement. Leeches, astringent injections, cold hip-baths, and the recumbent position; are most effectual in reducing vascular engorgement. *Mechanical* means may then be resorted to with advantage, and they are the only remedial measures available in displacements depending on structural enlargements. These means consist in returning the prolapsus, and then supporting it in position by the introduction up the vagina of a properly-shaped pessary. The perforated cup-shaped pessary is generally the most suitable form; it slopes off into a hollow stem, and the stem moves externally on an ivory ball-and-socket joint, with an oval shield over the entrance to the vagina. The shield is enclosed in a close-fitting linen case, furnished with abdominal tapes, whereby the pessary is retained in position as the uterine support; the hollow stem draining off uterine discharge; and the ball-and-socket joint at the vulva allowing of free motion in every direction, without displacing the uterine support. I have used this apparatus in three otherwise uncontrollable cases of complete prolapsus uteri, the womb having descended beyond the vulva so as to hang between the thighs. In one of these cases, the patient was a young unmarried woman, who had never borne a child or been pregnant. In all, the relief afforded was most satisfactory, and a life of previous misery became enjoyable; the patients walking about with ease and comfort, and entering into society without restraint.

Displacements by version or flexion of the uterus may be rectified by passing the uterine sound into its cavity.

**TUMOURS.**—*Fibrous* tumour is of not uncommon occurrence. It may occupy any portion of the uterus; embedded in the uterine wall, projecting into the abdominal cavity, or pedunculated in the cavity of the uterus or even protruding into the vagina, as a fibrous polypus. The tumour is slow-growing, but may attain to a large size, weighing several pounds. In the two first named situations, fibrous tumour may occasion little inconvenience, and its presence remain unsuspected during life; but as a fibrous polypus, the growth may entail constant suffering and endanger life.

The age of production, or at least of discovery of uterine fibrous tumour, is usually between thirty and forty.

*Treatment.*—Removal of the tumour cannot be effected by absorption; and any medicinal treatment for this purpose, whether by the administration of iodine or mercury internally, or by the introduction of these agents into the vagina, will be of little or no avail.

On the other hand, the propriety of *operative* interference must be well considered.

The slight connexion, vascular or fibrous, between an embedded fibrous tumour and the uterine substance, is a structural condition favourable to removal of the mass by "Enucleation." When also the tumour is pedunculated, and presents into the uterine or vaginal cavity, its removal may be effected by Ligature. But the difficulty and danger of the former mode of operation, are serious considerations. The necessity for such operation should, therefore, always be determined by the presence and

urgency of symptoms. And the necessity thence arising will be absent, in proportion as the tumour is embedded, or projects into the abdomen.

*Enucleation* may have one of two objects in view; direct removal of the tumour at the time,—*primary* enucleation; or, the disturbance only of the relations of the tumour, so as to induce gangrene,—*secondary* enucleation.

The following conclusions, as to the relative propriety of these methods of operation, are offered for general guidance, by Mr. Jonathan Hutchinson, after much careful study of the subject:—(1) That Surgical interference with interstitial fibrous tumours of the uterus is always attended with considerable risk, and ought not to be practised except under circumstances of urgency, or when the position of the growth is peculiarly tempting. (2) That when the tumour is not of very large size, and is already partially extruded, the operation is rendered comparatively free of danger, and ought to be performed at once. (3) That when the tumour is wholly embedded, and even when of large size, enucleation is yet warrantable, if there be perilous hæmorrhage. (4) That primary enucleation, where at all easily practicable, is much preferable to the secondary method. (5) That where the tumour is very large, or where found after the incisions to be firmly united to its capsule, the secondary plan is preferable. (6) That whichever plan is adopted, the first incision should, excepting under unusual circumstances, be made from within the cavity of the cervix, and should be as free as possible. (7) That the danger of hæmorrhage from this incision is very slight. (8) That as much should be done as practicable at the first operation in freeing the tumour from its cyst. Thus if the adhesions be found more loose than had been expected, a primary enucleation may be completed where the slower plan had been proposed. (9) That in secondary enucleation, the Surgeon need not be anxious about the removal of the tumour *en masse*, but may confidently expect, that if sloughing be induced in its lower part, the piecemeal disintegration and death of the whole will follow.

*Operation of Enucleation.*—This mode of removing uterine fibrous tumours, has been practised chiefly within the last twenty years, and principally by Sir James Simpson, Mr. Teale, and Mr. Baker Brown, among British Surgeons. In America, Dr. Atlee has advocated and practised it in several cases; and in France, the operation has been performed by Lisfranc, Jarjavay, Amussat, and Maisonneuve. Mr. Jonathan Hutchinson has carefully analysed the experience derived from 39 recorded cases (*Medical Times and Gazette*, 1857), and he gives the following directions for performing the operation of *primary* enucleation:—1st. To have the tumour well depressed into the pelvis by an assistant. 2nd. To let the first incisions be very free, and pass deeply into the tumour, thus not only completely dividing its capsule, but facilitating its bisection, should that afterwards be found requisite. The scalpel should be passed into the uterine cavity, and then the edge turned on to the tumour, and the incision made downwards, and either forwards or backwards, according as the mass may occupy the anterior or the posterior wall. No important hæmorrhage attends this incision, and the whole substance of the tumour intervenes between the knife and peritoneum. 3rd. The capsule of the tumour having been opened, its separation should be effected by the finger, or if necessary, by blunt-pointed curved scissors, the finger being used as a director. The instruments here requisite occasionally; are curved scissors of various shapes and sizes, one of which should be very long, strong and

large vulsellæ, a blunt hook, a spatula, a scoop, and a pair of small mid-wifery forceps; also a strong whipcord ligature and the appliances for its use, should be at hand in case of need. 4th. Having separated the tumour from its cyst-wall, its lower part is seized and drawn down, so as to invert the uterus sufficiently to make room for removal of the tumour. Traction must be made in the axes of the pelvis, and steadily, not by jerks. 5th. Eversion having been accomplished, an examination should be made with the finger *per rectum*, in order to ascertain the relative position of the parts, and then the remaining attachments of the tumour must be cautiously separated. The utmost care must be taken not to cut into an inverted pouch of peritoneum. 6th. If the tumour be a large one, it may be found convenient, before drawing it down, to cut away a portion or portions and thus diminish its bulk. 7th. The operation complete, the inverted uterus must be returned; if necessary, a sponge-plug should be introduced, and a full dose of opium be given. 8th. Ice, ergot of rye, and diffusible stimuli must be resorted to, or not, according to circumstances.

*Secondary* enucleation, by inducing gangrene, requires no particular directions for its performance; the object being to disturb the relations of the tumour and inflict such injury on it as may lead to sloughing, and thence enucleation,—an occasionally natural mode of cure. By this method, several operations, after intervals of time, are usually requisite. Ergot should be administered, to maintain vigorous uterine action; the patient's strength sustained, and sloughs removed as soon as formed. In case of great exhaustion, and threatened pelvic inflammation, the internal administration of turpentine is of great value.

The *comparative results* of these two methods of enucleation may be thus stated; the primary method is more immediately serious, the secondary method entails a subsequent and protracted risk. The gross risk of the two modes is almost equal; but in either way, about two-thirds of the cases of enucleation end in recovery.

**UTERINE POLYPI.**—Various kinds and shapes of polypoid growths are liable to spring from the walls of the uterine cavity. (*a*) a sessile soft growth of small size, containing one or more mucous cysts, which consist of enlarged uterine follicles and hypertrophied cellular texture. Occasionally, pedunculated cysts attached to the cervix uteri: (*b*) a pedunculated growth of small size,—from that of a bean to a nut, soft, vascular, and often multiple, consisting of pendulous mucous membrane, and analogous to nasal mucous polypus; (*c*) a growth of finer texture and larger size,—a nut to an egg, more or less pedunculated, and consisting of mucous membrane, with a large excess of cellular tissue; (*d*) a much firmer growth than any of the preceding, and usually of much larger size, pedunculated or sessile, its attachment usually uterine,—the common fibrous polypus; (*e*) recurrent fibroid polypus; (*f*) malignant polypus.

*Signs.*—Hæmorrhage from the vagina is the most common symptom; occurring irregularly, sometimes copiously, and continuing for a long period, unrestrained by any ordinary treatment. The amount and frequency of the hæmorrhage often diminishes when the polypus escapes from the grasp of the cervix; and usually it lessens in proportion as the peduncle becomes longer and thinner. Leucorrhæal discharge is a less characteristic symptom. But, pain of a bearing-down character is experienced in all forms of uterine polypi. Examination *per vaginam* should be at once resorted to, by means of the speculum and digital exploration;



and then one or other of the above described polypoid growths will probably be discovered, protruding into the vagina.

*Diagnosis.*—Severity of pain is tolerably characteristic of *malignant* polypoid growth and hæmorrhage is usually more abundant. The period of life most liable to the *benign* forms of polypi is that of menstrual activity, rather than of very early or later life; but no age is exempt. Vaginal examination may determine the diagnosis.

*Treatment.*—Benign polypi admit of removal, by scissors, torsion, ligature, or écraseur. The risk of hæmorrhage should mainly determine the selection of either method of operation. But when the peduncle is long and thin; the best plan is to snip it through with scissors, or twist it with forceps until it gives way. Ligature may be applied by means of a noose of whipcord passed through Gooch's double canula; the ends of the cord are gradually tightened, and thus the ligature cuts its way through the peduncle in the course of a few days. During that time, however, a decomposing, fetid mass occupies the vagina, requiring the use of chlorinated injections to wash away the sloughing discharge. The uterine portion of peduncle gradually undergoes absorption.

**CANCER OF THE UTERUS.**—All forms of cancer may affect the uterus; either primarily, as being the seat of the disease; or secondarily, by invasion from other organs. Thus, we recognise scirrhus, encephaloid, and rarely colloid cancer of the uterus; also epithelial cancer and the so-called cauliflower excrescence. But it is only when seated in the os uteri, and at an early period of the disease, that uterine cancer is amenable to Surgical treatment.

*Signs.*—Pain and hæmorrhage, in a greater degree than as arising from any form of benign uterine tumour, are tolerably characteristic of cancer. But vaginal examination must always be had recourse to, and perhaps confirmed by microscopic examination of a small portion of the tumour or of the discharge from its surface. The disease usually commences in the form of a scirrhus tubercle of the cervix; which proceeds to ulceration, having the ordinary appearances of a cancerous ulcer, accompanied with offensive, muco-purulent and bloody discharge. Constitutional cachexia speedily ensues.

The *diagnosis* from syphilitic ulceration of the os uteri is often difficult, in an early stage of cancerous ulceration. A greater tendency of the latter to bleed, its warty and thickened edges and fetid discharge, are the most distinctive symptoms; affirmed or negated by microscopic examination.

As to the different species of malignant disease; the kind of cancer present is far less important than its extent.

*Treatment.*—When the disease is limited to the lips of the os uteri, and if the organ itself be unenlarged and freely moveable; any kind of cancer may be removed by excision, or caustic.

*Excision* of cancerous ulcer of the os uteri was originally performed by Oslander of Göttingen, and subsequently by Lisfranc of Paris. In this country, Sir James Simpson has had the largest experience of the operation. No particular directions are necessary for its performance; the operation consisting in dilating the vagina with the duck-billed speculum, seizing and dragging down the os with forceps, and then excising the affected portion. Hæmorrhage must be restrained by the actual cautery, or by perchloride of iron. It will perhaps be desirable to retain hold of the stump by transfixing it with a wire; so that in the event of secondary hæmorrhage, the requisite applications can be made.

The *results* of this operation are uncertain, both as to its immediate risks, and the average duration of life in successful cases. Death has not unfrequently occurred from hæmorrhage, or from a peculiar collapse,—the “abdominal collapse” of Dr. Barnes. When not immediately fatal, the operation is productive of only temporary benefit,—the disease returning. But in one case, Sir James Simpson removed a large epithelial cancer, and eighteen years afterwards, the woman was still in good health and had borne several children in the interval.

*Cauterization* will be preferable, when the disease extends too deeply for excision. For this purpose, the dried sulphate of zinc may be used, as recommended by Professor Simpson; and in the form of a powder introduced through a speculum, or as a pessary of ointment. Some carbonate of soda, in the form of a pessary, should also be applied, to neutralize the zinc which is apt to run. The chloride of zinc, and potass fusa, are less convenient kinds of escharotics; but the galvanic cautery may prove serviceable.

Cure has sometimes been effected, or at least a temporary alleviation of the symptoms.

*Palliative* treatment is alone available in cases unfitted for operation, owing to a more advanced extent of disease. Pain may be mitigated by opiates, hæmorrhage restrained by styptics, and fetid discharge corrected by detergent injections of chlorinated solutions, or Condy’s fluid.

ABSENCE OF THE UTERUS, AND OVARIES.—This congenital defect occasionally co-exists with imperforate vagina; the external organs of generation, constituting the vulva, being present, and the breasts developed.

The *signs* of this defective condition are these:—The patient may have attained adult age without ever having menstruated, and then an examination is instituted. Simultaneous exploration with the finger in the vagina and rectum, will ascertain whether the uterus can be felt; and its absence is confirmed by introducing a catheter into the bladder, the finger still remaining in the rectum, to feel that these two organs are in contact, without the uterus intervening as in the natural arrangement of the parts. The point of the instrument can be felt thinly covered through the gut. Sexual desire usually exists in this abnormality. And it has happened, that by fruitless attempts at sexual intercourse, the urethral orifice has become dilated to such an extent as to admit the finger into the bladder. Coitus has even been effected into the expanded urethra, as if into the vagina; and thus the existence of the malformation has remained undiscovered.

No operation can be of any use; and any attempt to restore the vagina would necessarily open up the peritoneal cavity and have a fatal result.

(3) THE OVARIES.—TUMOURS, AND OVARIAN DROPSY. — Ovarian Tumours are of two kinds, *Solid* and *Cystic*.

*Solid* ovarian tumours may be either *Fibrous*, or *Cancerous*, most frequently colloid, and of a cystic rather than of a solid character, rarely encephaloid.

*Cystic* ovarian tumours, comprise; *simple* cysts, with fluid contents, and single or multiple; *proliferous* cysts, having colloid contents, or solid growths. These varieties of cysts are less frequently met with independently, but as associated in the same tumour; which thus presents the characters of a compound tumour. The activity of proliferous tendency is an indication of the affinity of the tumour to cancer growth.

As to the *relative frequency* of the different forms of ovarian disease, Dr. West supplies the following data:—of 60 cases, 41 recorded by Scanzoni and 19 by himself, simple cysts occurred in 15, fat cysts in 1; proliferous cysts, with cysto-sarcoma in 23; colloid cancer in 19, cancer with cyst-formation in 2.

*Dermoid* Cysts are not included in the above forms of ovarian disease. These peculiar cysts contain all the appendages of the skin; hair, teeth, &c., and fatty secretion. Both ovaries are equally liable to cystic disease. Of 75 cases collected by Dr. West,—19 of his own cases, 15 of Dr. R. Lee's, and 41 of Scanzoni's—in about one-third, both organs were affected. It is usually believed that the right ovary is more commonly affected than the left.

*Diagnosis.*—Ovarian tumours must be distinguished from other abdominal tumours:—from the gravid uterus in pregnancy, tumours of the uterus, omental tumours; ascites, hydatids, dropsy of the Fallopian tubes; enlargements of the liver, kidney, spleen, and stomach; hysterical tympanitis, faecal accumulations, distension of the bladder, abdominal and pelvic abscesses, and spinal curvature. The utmost care and caution must be taken in the diagnosis, before laying open the abdominal cavity for the removal of a supposed ovarian tumour, and then only discovering its real nature.

*Causes.*—No *period of life* is free from the liability to ovarian disease. During the whole period of sexual activity, it is of tolerably frequent occurrence; but in the latter half, or from thirty to forty-five, it is most frequent. It is very rare in childhood; and decidedly uncommon after the complete cessation of menstruation. It is relatively more common in *single* than in married women; and of the latter, a large proportion have been *sterile*, or not readily impregnated. Age and sexual condition afford little or no aid in the diagnosis of an abdominal tumour, as to its being ovarian. Sterility or feeble fecundity is an association of somewhat more significance, but the sexual functions may be quite healthy.

*Rate of growth.*—Commonly, in from *two to three* years from the commencement, or first discovery, of the tumour, it will have attained to such size as to occupy the abdomen, and produce various inconveniences as the result of pressure on the viscera. Sometimes the growth is much more rapid, and occasionally, especially in the aged, it may be much slower.

The *natural course* of ovarian tumours subsequently is less certainly known, treatment usually having been resorted to when it has become a source of serious inconvenience. But in patients under forty years, ovarian dropsy not interfered with, gradually undermines the general health; partly by functional derangements in consequence of unrelieved pressure, and partly by the demands of the tumour as a drain on the patient's strength. Thus, by pressure, the process of assimilation is interrupted, the circulation obstructed so that the legs become œdematous; the respiration embarrassed by upward displacement of the diaphragm and ribs; the patient can no longer rest in the recumbent posture, and worn out by sleepless nights and protracted suffering, death ensues at the end of one or two years from the date of abdominal inconvenience. Sometimes, intercurrent attacks of peritonitis, or of one of the cysts in the tumour, carry off the sufferer before the period of what may be called her natural release.

*Spontaneous cure* has been known to occur; either by cessation of



secretion and then progressive absorption, or by rupture of a single cyst into the peritoneal cavity, the intestine, or the vagina, and thus the subsidence of the tumour. But the former mode of cure is a very rare event; the latter has happened occasionally, yet always in a manner precarious or perilous, and has proved fatal instead of curative.

TREATMENT.—No medicinal measures, internal or topical, have any influence in curing ovarian tumours. Surgical treatment comprises:—(1) the Palliative operation of *Paracentesis* or Tapping, repeatedly performed as occasion may require; (2) Tapping, with various measures for inducing *Obliteration* of the cyst; as by injection of tincture of iodine, or by mechanical compression, or by the attempt to establish fistulæ for drawing away the re-secreted fluid; (3) *Ectirpation*, or *Ovariectomy*.

(1) *Tapping* is available only in Cystic tumour; where the cyst is single, or in multilocular tumours where one cyst greatly predominates in size. It affords temporary relief, re-secretion of the fluid rapidly taking place; and this entails a drain upon the patient's strength greater than would have occurred from continued secretion in a full cyst; it necessitates also a second tapping, and even many subsequent operations, each at progressively shorter intervals. The duration of life, under repeated tapplings, is probably shorter than when the tumour is left to itself; death usually taking place in three or four years after the first operation. The immediate risk from tapping is not inconsiderable; rapid exhaustion, or fatal peritonitis, sometimes occurs; and acute inflammation of the cyst occasionally. Puncture of an adherent coil of intestine must not be overlooked as a possible contingency. The operation is performed as for ascites, the point selected for puncture being one of absolute dulness; and this is usually in the middle line, a little below the umbilicus. Some other part of the abdominal wall may be more eligible, as in the linea semi-lunaris. A multilocular tumour may perhaps be partly emptied by introducing the trocar at different points, into its most prominent loculi.

(2) *Obliteration of the Cyst*.—*Injection* of the tincture of iodine, is an appropriate mode of effecting obliteration of an ovarian cystic tumour, when the cyst is single. But, in such case, the diagnosis from ascites must be very carefully ascertained; as the danger consequent on injecting the peritoneal cavity—the production of peritonitis, would be much greater than if ovariectomy were attempted by an error of diagnosis. Acute cyst-inflammation is another source of danger. If the tumour be multilocular, inflammation is very apt to follow in the uninjected cysts, in consequence of the adjoining source of irritation. Lastly, secondary cysts, which had been suppressed by the pressure and growth of a larger, predominating cyst, may subsequently become developed; thus converting an apparently unilocular cyst into a multilocular tumour, and rendering the operation abortive as a radical cure. The operation is performed by first tapping the tumour in the ordinary manner, and introducing a flexible catheter through the canula to draw off as much fluid as can be obtained; then from four to six ounces of the tincture should be injected and retained, or after about a quarter of an hour allowed to drain out. A diluted solution of the iodine might be preferred, as was recommended by Boinet, who originated this method of treatment; but there will always be a certain quantity of fluid remaining in the cyst, sufficient to dilute the tincture. Inflammation of the cyst with the effusion of plastic matter into the interior, soon follows the injection; and by this moderate degree of the process, a cure is effected.

*After-treatment* must, therefore, be directed to regulate the inflammation; stimulants or opiates being given according to the symptoms.

Sometimes the constitutional disturbance is considerable; a severe febrile paroxysm supervening with intense iodism, and impregnation of the urine and saliva with iodine.

The *results of Injection* have been not unfrequently successful; and it would seem to be less perilous than *ovariotomy*.

*Compression*, by means of a starch bandage applied to the abdomen, as a mode of effecting obliteration of the cyst, after tapping; is a plan of treatment which is now generally acknowledged to be at least useless.

*Fistulous channels* communicating with the interior of the cyst, through the abdominal wall, or through the vagina or rectum; is also a mode of obliteration which has fallen into almost entire disuse, as being more hazardous than *ovariotomy*. It is, moreover, a long, painful, and exhausting method; and the permanency of cure is very uncertain. This method would be applicable only where the tumour is unilocular.

(3) *OVARIOTOMY*.—Extirpation of Ovarian tumours, cystic or solid, is an operation of comparatively recent date. Suggested by Dr. William Hunter, advocated by John Bell, and first practised by Dr. McDowell in 1809, the latter an American pupil of John Bell, *Ovariotomy* is therefore unquestionably an operation of British origin; and it is to the labours of British Surgeons that its subsequent progress is chiefly due. The woman first operated on recovered, and survived for many years. Mr. Lizars of Edinburgh, attempted the first operation in Great Britain, in 1823; but the abdominal enlargement was found to be due only to obesity and tympanitis. The patient recovered. In London, the first attempt to perform *ovariotomy* was made by Dr. Granville, in 1827; the operation was abandoned on account of the extent of the adhesions. This patient also recovered. Both these operations had been done by the *long* incision, extending from the sternum to the pubes. The *short* incision, originally suggested by William Hunter, was first practised by Mr. Jeaffreson of Framlingham, in 1836; the patient recovering, and afterwards bearing children.

The first *completed* operation in *London* was performed by Mr. Benjamin Phillips, at the Marylebone Infirmary, in 1840; but the result was unsuccessful. The first *successful* case in the metropolis, fell to the lot of Mr. Walne in 1842, followed by two other successful cases in 1843. At length, in 1846, Mr. Cæsar Hawkins performed the operation successfully at St. George's Hospital; this being the first successful case by a Surgeon of any of our Metropolitan Hospitals. *Ovariotomy* has been *established* as a recognised operation in Surgery; by the labours of Dr. Clay of Manchester, who, in 1842, commenced his series of cases; by Dr. Frederic Bird, who began in 1843; by Mr. Lane, in 1844; by Mr. Baker Brown, in 1852; and by Mr. Hutchinson, in 1858; but Mr. Spencer Wells, commencing his long series of operations in 1857, has performed *Ovariotomy* in now 400 cases, and with such careful analysis and continued publication of his results, that they represent the most authentic source of knowledge on this subject.

*Conditions favourable and unfavourable for Ovariotomy, and the Selection of Cases*.—The following general conclusions are gathered from Mr. Spencer Wells' Report of his first and second hundred cases.

(1) The probable result of *Ovariotomy* can be estimated with far greater accuracy by a knowledge of the general condition of the patient.

than by the size and condition of the tumour. In other words, a large tumour, extensively adherent, in a patient whose heart and lungs, and digestive and eliminative organs are healthy, and whose mind is well regulated, may be removed with a far greater probability of success; than a small unattached cyst from a patient anæmic, whose heart is feeble, whose assimilation and elimination are imperfect, or whose mind is too readily acted upon by either exciting or depressing causes. Hence, the explanation of a commonly received erroneous belief; that the more advanced the disease the greater, and the earlier the stage of the disease the less, is the probability of recovery.

(2) Age.—Below the age of twenty, and between forty and fifty, the mortality is less than that between twenty and forty, or above fifty.

(3) Conjugal condition.—Among married and unmarried women at all ages, the mortality was nearly equal in the first 100 cases; and decidedly less among the unmarried women in the second 100 cases. As to any particular age, the data for comparative mortality are insufficient.

(4) Social condition.—In Hospital cases, the mortality is about 30·4 per cent.; in Private cases, about 30·6 per cent.; or nearly identical.

(5) Influence of Season.—In spring and summer, the mortality seems to be rather lower, than in autumn and winter; but the result of ovariectomy is not much influenced by season.

(6) Adhesions of the tumour.—Adhesions to the abdominal wall, omentum, or intestines, appear to have little, if any, influence upon the mortality; so that the importance which has been attached to the diagnosis of these adhesions before operation has been very greatly and unnecessarily exaggerated. But, adhesions within the pelvis, to the bladder or rectum, or around the brim of the pelvis, are very significant; as they may be inseparable without great and immediate danger to life, by injury to those organs, or to the iliac vessels or the ureters. The diagnosis of *such* adhesions is of the utmost importance. And the closeness of the connexion between the uterus and the ovarian tumour,—the length of the pedicle, will determine the possibility of keeping the end of the secured pedicle outside the peritoneal cavity, or the necessity for leaving it within this cavity. Mr. Duffin, in 1850, inaugurated a new era in ovariectomy; by pointing out the danger of leaving the ligatured end of the pedicle to decompose within the peritoneal cavity, and the great importance of keeping the strangulated stump outside. The probability of success is nearly *doubled* where the length of pedicle permits of this arrangement.

(7) Size of tumour, has not, by itself, appeared to affect the result; but size and solidity together, are important in so far as they affect the *length of incision* requisite for removal of the tumour. Of the 100 cases, it was necessary to carry the incision above the umbilicus in 20 patients. Of these, 9 died; a mortality of 45 per cent. In 80 cases, the incision did not extend above the umbilicus. Of these, 25 died; a mortality of 31 per cent., or 14 per cent. in favour of the short incision.

(8) Influence of Tapping.—As affecting the operation of Ovariectomy, the prior performance of Tapping has certain relations which are indicated by Mr. Spencer Wells' *third* series of 100 cases. That one or many tapplings do not considerably increase the mortality of ovariectomy. That tapping may often be a useful prelude to the operation; either by giving time for the general health to improve, or by lessening the shock when



the fluid is removed a few days or hours before removing the more solid part of an ovarian tumour. That when the siphon-trocar is used in such a manner as to prevent escape of ovarian fluid into the peritoneal cavity, and of entrance of air into the cyst, the danger of tapping is very small.

*Operation.*—The *Instruments* requisite for Ovariectomy are, scalpels, director, a large trocar and canula, or two, and elastic tube, strong vulsellum-forceps, clamp, whipcord ligatures, strong nævus-needles for carrying ligatures, hare-lip pins, and silver-wire sutures; strips of new flannel, and large fresh sponges, soaked in warm water. The room should be raised in temperature to 70° or 75° F.; and the patient remain if possible in the room after operation.

No special preparation of the patient is necessary; excepting that the bowels should have been opened by a gentle aperient of castor oil, on the day previous to, and by an enema on the morning of, operation; and the patient should be in her usual health.

Ovariectomy consists generally of the following seven steps or procedures in succession:—An incision in the middle line or linea alba between the umbilicus and pubes; introduction of the fingers or hand into the peritoneal cavity to gently explore the situation, nature, and extent of any adhesions, in order to determine the practicability of completing the operation; tapping the tumour, if cystic; cautious separation of any recent adhesions; securing the pedicle with a clamp, leaving a sufficient length free as a safeguard against slipping; division of the pedicle, at that distance from the clamp externally, and removal of the tumour; closure of the wound, leaving the stump and the clamp protruding through it externally.

In carrying out these directions, certain *particulars* must be observed, as essential to the probable success of the operation.

The patient clad in blankets, and chloroform having been administered; the bladder is emptied by a catheter, and the patient drawn to the end of the table, so that her legs shall hang down and the abdomen be fairly exposed. The Surgeon standing between the patient's legs, he makes an incision in the middle line or linea alba, commencing about two inches below the umbilicus and carried down to about four inches in length. By a few horizontal touches of the knife, the abdominal wall, which is usually much thinned, is divided, and the peritoneal cavity laid open. Care must be taken not to mistake the peritoneal membrane for the cyst-wall, and thus proceed to detach that membrane from the fascia transversalis; an error which has occurred several times. The peritoneum having been opened sufficiently to introduce the finger, it should be slightly raised from the cyst to make certain of this fact, and then laid open on the finger.

A longer, or even a shorter, incision may be requisite, according to the size of the tumour, and the situation and extent of the adhesions. But it cannot be necessary ever to have recourse to the long incision, extending from the sternum to the pubes as formerly practised. The fingers or the hand are now introduced into the peritoneal cavity, and the existence of adhesions ascertained, their situation, nature, and extent. They may be such as to determine the propriety of not completing the operation; the abdominal section would then have to be closed, and the patient removed. When, as usual, the operation is *proceeded* with; the tumour, if *cystic*, should be tapped, in order to more conveniently effect

its removal and through an abdominal aperture of smaller size, than would otherwise be requisite. A large trocar and canula (Fig. 469) is thrust into the most prominent part of the tumour, and the fluid drawn off through the canula. Especial care must be taken to prevent any of the ovarian fluid escaping, or passing from the canula, into the abdominal cavity; and a long vulcanized india-rubber tube fitted to the canula (see Fig. 469) will be the best safeguard. A little alteration of the patient's position, on to her side, and some compression of the abdomen, may prove advantageous in emptying the cyst.

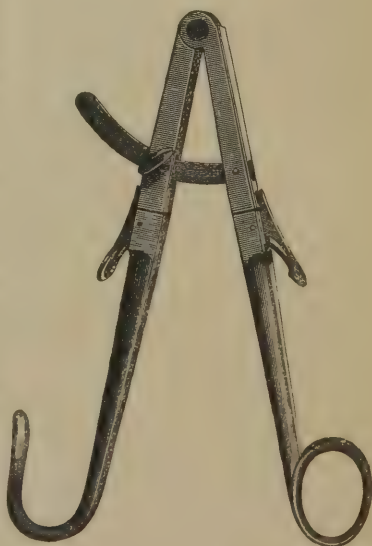
If there be no adhesions, the tumour is now seized with a strong vulsellum and easily drawn out, as a bag, through the abdominal aperture; an assistant or two at the same time following up and closing the wound around the pedicle, so as to prevent any escape of the intestines, by handling the wound with strips of flannel wrung out of warm water. If there be any *adhesions*, or the tumour be *solid*, the fingers or hand must be passed into the abdominal cavity; the same precaution being taken by the assistants during this manipulation. When the adhesions are slight and situated anteriorly, they are readily separated by passing the hand round the front part of the tumour. When they are firm, deep-seated and extensive, the operation becomes proportionately difficult and perilous. Fortunately such adhesions are comparatively seldom found posteriorly, or connecting any of the abdominal viscera, except the uterus. These bands should be torn through, and very cautiously, not to injure the attached organ; any division with the knife being unsafe, on account of the liability to *hemorrhage* from the vessels which commonly exist in firm, organized adhesions. Any risk of *laceration* of the attached organ,

as intestine or liver, must, however, be especially avoided; and it will be more proper to cut across and leave the closely adherent portion of cyst-wall, than incur the danger of visceral rupture.

The *pedicle* protruding through the abdominal incision, as guarded by assistants; the Surgeon proceeds to secure it. This may be effected either by means of a clamp, or by ligature. The former is especially applicable when the pedicle is long and narrow; and various modifications in the form of the instrument have been proposed by different ovariotomists, each



Fig. 470.



rejoicing in the perfection of his own clamp. The form of clamp devised by Mr. Spencer Wells, is now generally employed. The two blades, com-

pressing the pedicle, are fixed by a screw (Fig. 470); and then the handles are detached, leaving a small, light instrument in connexion with the wound. Ligature will be more appropriate when the pedicle is short and thick, whereby the clamp would be drawn inwards to the pelvic cavity, or the uterus be drawn upwards forcibly towards the surface. The whipcord ligature seems to answer best, and it should be applied by transfixing the pedicle with a *navus*-needle armed with the ligature, and tying each portion securely. Care must be taken not to transfix any large artery or vein, the latter vessels particularly being large-sized, and thin-walled. The pedicle is now to be divided, at a sufficient distance beyond the clamp externally to prevent any risk of its slipping through, and thence of subsequent hæmorrhage. The ovarian tumour is thus detached.

*Closure of the wound*, leaving the clamped peduncle protruding, concludes the operation. This step may be accomplished either with hare-lip pins and twisted suture or by strong wire sutures: and these may be introduced through the entire abdominal wall including the peritoneum, or through its whole thickness, excluding the latter. They should be placed an inch and a half from the edge of the incision, on either side, so as to have a firm grasp; and not more than three-quarters of an inch apart. The lowest should be carried close to the peduncle, or it may be advisable to transfix it; and if the ligature be used, the ends may be fastened around a hare-lip pin transfixing the peduncle. Thus retained *in situ*, there will be no chance of any slough, or ligature, falling back into the peritoneal cavity. The pins and clamp are then to be padded with lint, and a four-tailed flannel bandage well applied over the abdomen. A warmed bed should be at hand for the reception of the patient, and any slight stimulant administered which occasion may require.

*After-treatment* is very important, and it comprises chiefly the following general directions. They have reference specially to the three sources of danger after ovariectomy; peritonitis, exhaustion, secondary hæmorrhage. To avoid any tendency to vomiting after the operation, nothing should be taken by the mouth during the first twelve hours, but a little ice, and no opium or other medicine. Milk or beef-tea should form the nourishment for several days; with wine or brandy as stimulants, and opium, according to the constitutional state of the patient. The nourishment may be administered by enemata, if the stomach continue irritable. No action of the bowels must be allowed, if possible, for ten days, the influence of opium having the advantage also of checking intestinal action; and the urine should be drawn off by a catheter two or three times a day. *Peritonitis* must be treated on ordinary principles, as in connexion with strangulated hernia. The management of the *wound* is simple. The portion of pedicle left external to the clamp may be cut off on the day following the operation, as there will then be no risk of slipping, and it is very desirable to avoid any source of decomposing matter. The clamp itself may be removed on the second or third day. The hare-lip pins should be left to the fourth or fifth day; and when they are removed, great care should be taken to support the abdomen and wound, by long and broad strips of plaster, and firm application of the flannel bandage.

The *results* of ovariectomy have been increasingly successful. Two recoveries, at least, to one death is a proportion which may fairly be expected in practised hands. Dr. Clay's table of cases, gathered from all



sources, gives us 212 recoveries to 183 deaths. But this is surpassed by the more favourable results of Mr. Spencer Wells' 400 cases, in which he has completed the operation of Ovariectomy; the last 100 having been only just brought, as I now write, before the Royal Medical and Surgical Society. He finds that the mortality lessens as experience increases. Of the first 100 cases, 34 died, and 66 recovered; of the second 100, 28 died, and 72 recovered; of the third 100, 23 died, and 77 recovered. But of this fourth series of 100 cases, only 22 died, and 78 recovered;—44 having been in hospital, and 56 in private practice. Of the former, the mortality was 31 per cent; of the latter, it was only 14 per cent. The mortality in private practice, Mr. Wells believes, may be taken as a guide to what may become the general average after ovariectomy; and he is convinced that,—including extreme cases, where the operation is performed as a forlorn hope, this average mortality may be reduced to about 10 per cent. One of the grandest triumphs of Modern Surgery.

---

# INDEX.

---

**ABDOMEN**, abscess of parietes, 908  
 contusion of parietes, 907  
 rupture of viscera, 908  
 treatment of, 910  
 injuries of, 907  
 consequences, 910  
 progress, 910  
 symptoms of, 908  
 treatment of, 910  
 tapping the, 910  
 wounds of, 908  
 of parietes, 908  
 penetrating, 908  
 of viscera, 908  
 protrusion of, and with wound, 909  
 treatment of, 910  
 traumatic peritonitis, 912

**Abscess** (*abscedo*, I go away), 52  
 treatment of, 75  
 chronic, 53  
 treatment of, 77  
 diagnosis from aneurism, 323  
 from cysts, 86  
 drainage tube, 77  
 fistula from, 53  
 treatment of, 77  
 formation of, 52  
 Hilton's method of opening, 76  
 incision in, 75  
 lymphatic, 409  
 from dissection wound, 214  
 multilocular abscess, 53  
 pointing of, 53  
 pyogenic membrane of, 52  
 phlegmonous, 80  
 secondary, 209  
 treatment of, 77, 216  
 signs of, 52  
 sinus from, 53  
 treatment of, 77  
 situations of, 54  
 size of, 52  
 structure of, 52  
 translation, abscess by, 54  
 signs of, 54  
 treatment of, 77  
 treatment of, 76  
 puncture of, 77  
 ulcer from, 53  
 varieties of, 53

**Abscess**, alveolar, 808

**Abscess** (*continued*)—  
 of antrum, 818  
 near anus, 985  
 of areola, 894  
 bone, 489  
 breast, 892  
 bursa patellæ, 315  
 in frontal sinuses, 795  
 in groin, origin of, 869  
 diagnosis of, 869  
 from aneurism, 364  
 of gums, 808  
 in hip-disease, 590  
 diagnosis, 590  
 iliac, 593, 869  
 diagnosis from aneurism, 362  
 from fatty tumours, 870  
 from psoas abscess, 870  
 from pericæcal abscess, 870  
 from perinephritic abscess, 870  
 ischio-rectal, 985  
 in joints, from synovitis, 574, 578  
 scrofulous caries, 580  
 ulceration of articular cartilages, 584  
 laryngeal, 845  
 mammary, 892  
 chronic, 893  
 in neck, diagnosis from carotid aneurism, 353  
 nose, 735  
 diagnosis from polypus, 787  
 pericæcal, diagnosis of, 870  
 perineal, 1124  
 popliteal, diagnosis from aneurism, 367  
 post-pharyngeal, 841  
 prostatic, 1085  
 psoas, 869  
 diagnosis from other inguinal swellings or tumours, 869  
 sacro-iliac, 593  
 diagnosis, 593  
 in spinal caries, 868  
 intra-mammary, 892  
 sub-mammary, 892  
 super-mammary, 892  
 of testis, 1153  
 tongue, 804  
 tonsil, 839  
 urethral, 1099  
 urinary, 1124

- Abscession of cornea, 770  
 Absorbents. *See* Lymphatics  
 Absorption of lymph, 44  
 Acetabulum, disease of, 588, 633  
     fracture of, 463  
 Acritochromacy, 769  
 Acromion, fracture of, 450  
 Acupressure (*acus*, a needle; *premo*, I press), 261  
     compared with ligature and torsion, 265  
     methods of, 261  
     occlusion of arteries after, 263  
     results of, 262  
         relative to secondary hæmorrhage, 262  
         primary adhesion, 264  
         pyæmic infection, 264  
 Adenitis (*ἀδὴν*, a gland; *itis*, denoting inflammation), 410  
 Adenocoele (*ἀδὴν*, a gland; *κῆλη*, a tumour), 895  
 Adhesion, primary, 245  
     of wounded arteries, 256  
 Adhesions in hernial sac, 916  
     management of, 931  
 Adhesive arteritis, 399  
     inflammation, 43  
     phlebitis, 407  
 Adipose tumours. *See* Fatty Tumours  
 Aërial fistula, 830  
 Agalactia, 906  
 Air in veins, 267  
     causes of, 268  
     modes of death from, 267  
     period of death from, 267  
     spontaneous entry of, 267  
     symptoms of, 267  
     treatment of, 268  
 Air-passages, foreign bodies in, 830  
     auscultatory signs of, 830  
     diagnosis of, 830  
     inflammation from, 831  
     obstruction by, 830  
     operations for removal of, 831  
     prognosis of, 831  
     results of, 832  
     symptoms of, 830  
     treatment of, 831  
     introduction of instruments into, 847  
     operations on, 831. *See* Laryngotomy and Tracheotomy  
     wounds of, 827  
         consequences of, 828  
         effects of, 828  
         prognosis of, 828  
         situations of, 828  
         superficial and deep, 827  
         treatment of, 829  
 Ala nasi, restoration of, 794  
 Albuminuria, after excision of joint, 626  
     in relation to lithotomy, 1053  
     to lithotripsy, 1066  
 Allarton's operation of lithotomy, 1055  
 Alopecia (*ἀλωπηξ*, a fox), syphilitic, 187  
 Alternating calculus, 1023  
 Alveolar abscess, 808  
 Amaurosis, 762  
     ophthalmoscopic appearances, 763  
 Amputations (*amputo*, I lop off) in general, 680  
     assistants in, 681  
     conditions affecting result of, 688  
         of injury and disease for, 680  
         for disease and injury compared, 689  
         double, 687  
         by double flaps, 681  
         dressing of stump, 684  
         re-dressing of, 685  
         healthy stump, 687  
         instruments for, 680  
         morbid conditions of stump, 685  
         hæmorrhage, primary, 681  
         secondary, after, 685  
         ligatures in, 681  
         by long flap, 684  
         methods of performing, 681  
         mortality after, 688  
         operation of by flaps, 681  
             circular, 681  
             relative merits of, 683  
         primary and secondary compared, 689  
         by rectangular flaps, 684  
         results of, 688  
         in injury and disease, 689  
         sawing bone in, 682  
         secondary, 689  
         simultaneous, 667  
         statistics of, 689  
         stumps after, 684-7  
         sutures in, 685  
         for ankylosis, 586  
         aneurism. *See* Amputations, special, and Aneurism  
         burns, 299  
         cancer of bone, 504  
         caries, 493  
         contused and lacerated wound, 275  
         dislocation, compound, 520  
             after excision of joints, 612  
         for fracture, compound, 427. *See also* Amputations, special, and Fracture  
         frost-bite, 301  
         gangrene, 151  
             from dislocation, 520  
             fracture, 427  
             after ligature, 337  
         gun-shot wounds, 288  
         joint-disease. *See* Excisional Surgery  
         necrosis, 497  
         osteo-aneurism, 505  
         osteo-myelitis, 488  
         wounds of joints, 508  
 Amputations, particular, 690  
     at ankle, Pirogoff's, 701  
     Syme's, 700  
     artificial foot, forms of, 703  
     results. *See* Excisional Surgery



Amputations (*continued*)—

- of arm, 694
  - artificial arm, forms of, 696
  - results of, 695
- breast, 904
- fingers, 690
- foot, 697
  - Chopart's, 699
  - Hey's, 698
  - excision compared, 646
  - sub-astragaloid, 701
  - compared with excision of os calcis, 649
- Hancock's amputation, 702
- forearm, 693
  - artificial forearm, forms of, 694
  - results of, 675
- great toe, 697
- hand, 690
- at hip-joint, 710
  - for hip-disease, 639
  - results of, 712
- at knee-joint, 704
  - results of, 706
  - through condyles, 706
- of leg, 703
  - artificial leg, forms of, 704
  - results of, 704
- of little toe, 698
- of lower limb, 697
  - results of, 690
- at metacarpo-phalangeal joints, 691
- of metatarsal bones, 698
- at metatarso-phalangeal joints, 697
- of penis, 1134
- at shoulder-joint, 696
  - results of, 697
  - in subclavian aneurism, 353
- through tarsus, 699
- of thigh, 706
  - by antero-posterior flaps, 707
  - artificial limb, forms of, 709
  - for compound fracture, 427
  - for fracture with wound of artery, 430
  - for popliteal aneurism, 369
  - results of, 710
  - through trochanters, 711
  - Vermale's, 703
- of thumb, 692
- of toes, 697
- of upper limb, 690
  - results of, 690
  - at wrist, 693
  - artificial hand, forms of, 693
- Amussat's operation for artificial anus, 496
- in children, 502
- Anæsthesia (*â*, negative; *αἰσθάνομαι*, I perceive), 12. *See* Chloroform
- local, 18
- Anal tumours, 1012
  - contraction, 1012
- Analysis of cases of joint-excision. *See* Excisional Surgery
- Anasarca, 1136
- Anatomy and physiology of vertebral column, 856
- Anatomy of arteries. *See* Ligature of Arteries, 370
- Anatomy of herniæ. *See* Special Hernia, 938
- Anastomosing vessels, enlargement of after ligature, 333
- Ancyloblepharon, 738
- Anchylolysis (*ἀγκύλος*, crooked), 584
  - causes of, 585
  - of arm, 650
  - complete, 584
  - of elbow, 649
    - excision for, 650
  - fibrous, 585
  - in hip disease, 588
  - incomplete, 584
  - of knee, angular, forwards, 585
  - osseous, 585
  - treatment of, 585
- Anel's operation for aneurism, 334
- Aneurism (*ἀνα*, through; *εἰρύνω*, I widen)
  - in general, 321
  - age, influence of, 324
  - amputation for. *See* Special Aneurisms
  - for gangrene after ligature in, 337
  - for recurrent pulsation after ligature, 337
  - for suppuration of sac of, 338
- by anastomosis, 105
  - treatment of, 105
  - in tongue, 359
- aneurismal varix, 343
- atheroma a cause of, 323
- bruise a cause of, 324
- of bone. *See* Osteo-Aneurism, 505
- bruit in, 322
- causes of, 323
- external, 324
- predisposing, 324
- circumscribed, 321
  - signs of, 322
- after ligature, 334
- classification of, 324
- climate, influence of, 324
- death from, 325
- definition of, 321. *See* Special Aneurisms
- diagnosis of, 323
  - from abscess, 323
  - aneurism by anastomosis, 323
  - erectile growths, 323
  - non-pulsating tumours of bone, 505
  - osteo-aneurism, 505
  - osteo-cancer, 504
  - tumours, non-pulsating, 323
  - pulsating, 323
- diffused, 321
  - symptoms of, 322
- dissecting, 322
- duration of, 328
- effects of, 323
  - constitutionally, 325
  - locally, 325
- false, 321

*Aneurism (continued)*—

- circumscribed, 321
  - diffused, 321
  - fatty degeneration a cause of, 323
  - formation of, 321
  - fusiform, 321
  - gangrene in diffused form of, 322
    - after ligature, 337
  - hæmorrhage after ligature, 338
  - idiopathic, 324
  - mixed, 321
  - muscular strain a cause of, 324
  - number of, 324
  - pressure-effects of, 325
  - prognosis of, 328
  - recurrent pulsation in, 335
  - rupture of, 325
  - sacculated, 321
    - false, 321
    - true, 321
  - secondary, 336
  - spontaneous cure of, 325
    - modes of, 326
  - suppuration and sloughing of, 337
  - symptoms of, 322
  - terminations of, 325
  - traumatic, 324
    - circumscribed, 324
    - diffused, 324
      - complicating fracture, 431
      - in reduction of old dislocations, 524
  - treatment of, 328
    - by compression, 329
      - statistical results of, 331
    - constitutional, 328
    - digital compression, 331
    - direct compression, 331
    - flexion, 332
    - galvano-puncture, 340
      - statistical results of, 341
    - injection, 341
      - results of, 342
    - ligature, 332. *See* Ligature
      - statistical results of, 338
    - manipulation, 339
      - results of, 339
  - tubular, 321
  - varicose, 343
  - wounds a cause of, 324
- Aneurism, special*
- of aorta, abdominal, 362
    - diagnosis of, 362
    - symptoms of, 362
    - treatment of, 362
      - results of, 362
  - thoracic, 347. *See* Aneurism, intra-thoracic
  - axillary artery, 359
    - causes of, 359
    - diagnosis of, 359
    - ligature of subclavian for, 360
    - symptoms of, 359
    - terminations of, 360
    - traumatic, 360

*Aneurism, special (continued)*—

- from attempts to reduce old dislocation, 524
- treatment of, 360
  - results of, 360
- brachial artery, 360
  - causes of, 360
  - terminations of, 361
  - treatment of, 361
    - results of, 361
  - traumatic, 361
  - varicose, 361
- brachio-cephalic artery. *See* Aneurism of Innominate Artery
- carotid artery, common, 353
  - causes of, 353
  - diagnosis of, 353
  - dysphagia from, 353
  - prognosis of, 354
  - symptoms of, 353
  - terminations of, 354
  - traumatic, 355
  - treatment of, 354
  - varix, 355
- internal, 355
- extra-cranial, 365
  - diagnosis of, 355
  - symptoms of, 355
  - treatment of, 355
- intra cranial, 355
  - in cavernous sinus, 356
  - at base, or in substance of brain, 357
  - intra-orbital, 356
- femoral artery, 365
  - common, 364
  - causes, 364
  - diagnosis, 364
  - symptoms, 364
  - terminations, 364
  - results, 364
  - traumatic, 365
  - varix, 365
    - deep, 365
    - superficial, 365
      - pressure, effects of, 366
      - traumatic, 366
      - treatment of, 366
        - results of, 366
      - varicose, 367
- gluteal artery, 363
  - traumatic, 363
- iliac artery, common, external, 362
  - internal, 362
    - diagnosis of, 362
    - symptoms of, 362
    - treatment of, 362
      - results of, 362
- of innominate artery, 349
  - dysphagia from, 350
  - dyspnoea from, 350
  - ligature for, 351
  - pain in, 350
  - pressure-effects of, 350
  - symptoms of, 349

Aneurisms, special (*continued*)—

- treatment of, 357
- results of, 351
- intra-cranial, 355
  - causes of, 357
  - death from, 357
  - frequency of, 356
  - pathology of, 357
  - pressure-effects of, 356
  - symptoms of, 355
  - treatment of, 357
  - results of, 358
  - traumatic, 358
- intra-orbital, 356
  - causes of, 356
  - diagnosis of, 356
  - pathology of, 356
  - treatment of, 357
- intra-thoracic, 347
  - auscultatory signs of, 347
  - diagnosis, 348
  - dysphagia from, 348
  - dyspnoea from, 348
  - oedema from, 348
  - pain in, 348
  - pressure-effects of, 347
  - pulsation and tumour in, 347
  - treatment of, 348
- neck, at root of, 349
  - causes of, 351
  - diagnosis by Dr. Cockle, 349
  - terminations, 351
  - treatment, 351
  - results of, 351
- of palmar arteries, traumatic, 361
- popliteal artery, 367
  - causes of, 367
  - diagnosis of, 367
  - diffused, 368
    - amputation for, 369
  - double, 369
  - symptoms of, 367
  - terminations, 368
  - treatment of, 368
  - results of, 368
  - traumatic, 369
- pubic artery, 363
- radial artery, 360
  - traumatic of, 361
  - varix, 361
- sciatic artery, 363
- subclavian artery, 358
  - causes of, 358
  - diagnosis, 358
  - ligature of brachio-cephalic artery for, 359
  - subclavian, 359
  - symptoms of, 358
  - terminations, 359
  - traumatic, 359
  - treatment of, 359
  - varix, 359
- tibial arteries, 369
  - symptoms, 369
  - treatment, 370

Aneurisms, special (*continued*)—

- traumatic, 370
- varix, 370
- ulnar artery, 360
  - traumatic, 361
  - varix, 361
- Aneurismal varix, 343. *See* Aneurism
- Angeioleucitis (*ἀγγεῖον*, a vessel; *λευκός*, white; *itis*, denoting inflammation), 409
- Angular curvature of spine, 367. *See* Spine
- Animal matter, decomposing. *See* Pyæmia
- Ankle, amputation at, 700
  - disease of, 580
  - dislocations of, 566
  - excision of, 643
  - fractures near and through, 480
  - compound, 483
  - gun-shot wounds of, 288
  - wounds of, 275
- Anthrax, 302. *See* Carbuncle
- Antiseptic dressings, 251
  - application of, dressing, 252
  - principle of, 252
  - results of, 254
  - theory of, 253
- Antrum, abscess of, 818
  - dropsy of, 819
  - puncturing of, 819
  - diagnosis from tumour, 820
  - tumours of, 820
- Anus, abscess near, 985
  - artificial, formation of, 981, 982, 935
    - by Amussat's operation, 982
    - by Callisen's operation, 982
    - in children, 1015
    - by Littre's operation, 982
    - by perineal section, 1015
    - results of, 983
    - in hernia, 935
    - treatment of, 937
- cancer of, 1012
- chancere of, 176
- closure of, 1014
  - by membrane, 1014
  - with absence of rectum, 1014
- condyloma of, 1012
- congenital malformations of, 1014
- contraction of, 1012
- fissure of, 991
- fistula of, 986. *See* Fistula in Ano
- imperforate, 1014
  - with communications of rectum—
    - vesical, vaginal, perineal, 1014
  - operations on, 1915
- prolapse of, 1002. *See* Prolapsus of rectum
- pruritus, 1018
- spasmodic contraction of sphincter of, 1018
- tumours of, 1012
- ulcer or fissure of, 991, 994



- Anus, diseases of, 985
- Aorta, abdominal, compression of, 362  
 ligature of, 386  
 thoracic, aneurism of. *See* Aneurism, intra-thoracic
- Aphonia ( $\acute{\alpha}$ , negative;  $\phi\omega\nu\eta$ , voice), 845
- Aplastic lymph ( $\acute{\alpha}$ , negative;  $\pi\lambda\acute{\alpha}\sigma\sigma\omega$ , I form), 41
- Apnoea ( $\acute{\alpha}$ , negative;  $\pi\nu\acute{\epsilon}\omega$ , I breathe). *See* Asphyxia
- Arcus senilis, 749
- Areola, abscess of, 894  
 inflammation of, 893
- Arm, amputations of, 694  
 ankylosis of, 585, 656  
 aneurism of vessels of, 360  
   traumatic, 361  
   varix of, 361  
   wounds, 361  
 arteries of, wounded, 361  
 contraction of, 597  
 deformities of, 597  
 fractures of, 452
- Arnott, Dr. J., cold as an anæsthetic, 18
- compression in cancer, 122
- congelation in cancer, 123
- Arteries, acupressure of, 261  
 adhesive process in, 256  
 aneurism of. *See* Aneurism  
 atheroma of, 323  
 calcification of, 323, 400  
   gangrene from, 145, 401  
 coagulum in wounded, formation of, 256-7  
 cold in wounds of, 258  
 contraction of, 258  
 contusion of, 256  
 degenerations of, 323  
   a cause of aneurism, 323  
 diseases of, 399  
 effects of ligature on, 259  
 embolism of, 145  
 enlargement of, in inflammation, 23  
 fatty degeneration of, 323  
 gangrene from obstruction of, 145  
 hæmorrhage from, 255  
   effects of, 256  
   natural arrest of, 256  
   signs of, 255  
   surgical treatment of, 258  
 inflammation of. *See* Arteritis  
 injuries of, 255  
   in contused and lacerated wounds, 271  
   in fracture, 431  
   in gun-shot wounds, 278  
   punctured wounds, 276  
   laceration of, 255  
 ligature of, 259  
   application of, 260  
   conditions appropriate for, 260  
   objections to, 260  
   occlusive process after, 259  
   compared with acupressure and torsion, 265
- Arteries (*continued*) —  
 occlusion of, 256, 265  
   by disease, 145  
   by natural processes, 256-8  
   after operation, 259-263  
 permanent closure of wounded, 256  
 pressure in wounds of, 259  
   of aneurism on, 327  
 punctured, 256  
 retraction of, 257  
 rupture of, 255  
   spontaneous, 324  
 torsion of, 264  
   compared with ligature and acupressure, 265  
   modes of, 265  
   occlusion, by, 264  
 wounds of, 255  
   in compound fracture, 430  
   treatment of, 430  
   gangrene from, 145  
   in hernia operations, 933  
   in lithotomy, 1051  
   treatment of, 258
- Artery or arteries, axillary, aneurism of, 359
- abdominal aorta, aneurism of, 362  
 compression of, 362  
 ligature of, 362  
 traumatic, 360  
 ligature of, 360, 380  
 wounds of, 360
- basilar, aneurism of, 357
- brachial, aneurism of, 360  
 traumatic, 361  
 varicose, 361  
 compression of, 361  
 ligature of, 361, 382  
 wounds of, 361
- brachio-cephalic. *See* Artery, innominate
- carotid, aneurism of, 353  
 traumatic, 355  
 varix of, 355  
 compression of, 357  
 ligature of, 354, 374  
   effects of on brain, 354  
   on lungs, 355  
 wounds of, 355
- internal, aneurism of, 355  
 extra-cranial, 355  
 intra-cranial, 355
- cerebral, 357
- epigastric, relation to femoral hernia, 961  
   to inguinal hernia, 940-1
- of face, wounds of, 795, 801
- femoral, aneurism of, 364  
 traumatic, 365  
 varicose, 365  
 compression of, 366  
 ligature of, 366, 392  
 relation to femoral hernia, 961  
 wounds of, 365  
 deep, aneurism of, 365

Artery (*continued*)—

- femoral, superficial, 365
    - traumatic, 366
    - varix, 367
  - compression of, 368
  - ligature of, 368
  - wounds of, 366
  - of foot, ligature of, 397
  - gluteal, aneurism of, 363
    - traumatic, 363
    - ligature of, 363
    - wounds of, 363
  - iliac, common, aneurism of, 362
    - ligature of, 363, 389
  - external, aneurism of, 362
    - compression of, 364
    - ligature of, 364, 388
  - internal, aneurism of, 362
    - ligature of, 389
  - innominate, aneurism of, 349
    - diagnosis of, 349
    - ligature of, 351, 372
  - intercostal, wounds of, 384
  - internal mammary, wounds of, 384
  - intra-cranial, aneurism of, 355
  - obturator, relation to femoral hernia, 960
  - palmar, 361
  - perineal, wounds of, in lithotomy, 1045
  - peroneal, ligature of, 399
  - plantar. *See* Arteries of Foot
  - popliteal, aneurism of, 367
    - double, 369
    - traumatic, 369
    - rupture, 369
    - ligature, 370, 393
    - wounds, 369
  - pudic, aneurism of, 363
  - radial, aneurism of, 360
    - traumatic, 361
    - varix, 361
    - ligature, 384
    - wounds of, 361
  - sciatic, aneurism of, 363
  - subclavian, aneurism of, 358
    - traumatic, 359
    - varix, 359
    - compression of, 360
    - ligature of, 359, 360, 377
    - wounds of, 359
  - temporal, aneurism by anastomosis of, 101
  - thyroid, ligature of, 352
  - tibial, aneurism of, 369
    - traumatic, 370
    - varicose, 370
    - anterior, ligature of, 370, 395
    - posterior, ligature of, 370, 397
    - wounds of, 370
  - ulnar, aneurism of, 360
    - traumatic aneurism of, 361
    - varix, 361
    - ligature, 385
    - wounds of, 361
- Arterio-venous aneurism, 343

- Arteritis (*arteria*, an artery; *itis*, denoting inflammation), 399
- adhesive, 399
  - causes of, 400
  - closure of artery by, 400
  - diffuse, 399
  - gangrene from, 145
  - symptoms of, 399
  - terminations of, 400
  - treatment of, 400
- Arthritis (*ἀρθρὸν*, a joint; *itis*, denoting inflammation), 572
- chronic rheumatic, 575
  - signs of, 576
  - pathology of, 576
  - terminations of, 577
    - of hip, 592
    - diagnosis of, 592
  - treatment of, 577
    - of jaw, 826
  - synovitis, 572
    - from ankylosis, 574
    - causes of, 573
    - chronic, 575
    - pathology of, 572
    - signs of, 573
    - suppuration in, 574
    - terminations of, 574
    - treatment of, 574
    - scrofulous, diagnosis of, 577, 578
    - pathological changes in, 577
    - symptoms of, 578
    - terminations of, 578
    - treatment of, 578
  - scrofulous disease of joint or caries, 579
    - pathology of, 579
    - signs of, 579
    - terminations of, 579
    - treatment, 581
  - ulceration of articular cartilages, 582
    - diagnosis of, 584
    - pathology of, 582
    - repair after, 584
    - signs of, 584
    - treatment of, 584
- Artificial anus. *See* Anus, artificial
- limbs. *See* Amputations
  - pupil, 754
  - respiration, 835
- Asphyxia (*ἀ*, negative; *σφύγις*, pulsation)
- artificial respiration in, 835
    - methods of, 835
  - causes of, 834
  - from chloroform, 16, 835,
  - from drowning, 834
  - from hanging, 834
  - from noxious gases, 834
  - post-mortem appearances, 833
  - symptoms of, 832
  - treatment of, 835
    - after treatment, 836
  - in wounds of throat, 828
- Asthenic (*ἀ*, negative; *σθενος*, strength)
- inflammation, 79

- Astragalus, dislocations of, 569  
 excision of, 646
- Atheroma (*ἀθήρα*, or *ἀθήρη*, porridge of meal) in arteries, 323  
 influence on aneurism, 324
- Atheromatous tumours, or wens, 731
- Atlas, disease of, 872  
 dislocation of, 872
- Atony of rectum, 1017  
 of bladder, 1083
- Atrophy (*ἀ*, negative; *τρέφω*, I nourish), 132
- Atrophy of breast, 895  
 of prostate, 1093  
 of testicle, 1158
- Axillary artery. *See* Artery, axillary glands, cancer of, 900, 905  
 strumous disease of, 893
- Axis, disease of, 872  
 dislocation of, 872
- Ayres's operation for extroversion of bladder, 1078

**B**ALANITIS (*βάλανος*, an acorn, also the glans penis; *itis*, denoting inflammation), 1130

- Bandages in eye operations 755, 759, 772  
 plaster of Paris, 423  
 starched, 423  
 after excision of joints, 612  
 fracture, 423  
 tight, gangrene from, 146
- Bed-sores, 860  
 treatment of, 861
- Bees, stings of, 243
- Belloq's sound, 783
- Bending of bone, 498  
 after badly-set fracture. *See* False-joint
- Biceps muscle, contraction of, 597
- Bigg's apparatus for contracted knee-joint, 600  
 for curvature of spine, 877  
 orthopede, 606  
 for talipes calcaneus, 605  
 triple-lever truss, 949
- Bilateral dislocation of jaw, 527  
 lithotomy, 1056
- Bites of rabid animals. *See* Hydrophobia, 223  
 of snakes, 228
- Bladder, atony of, 1083  
 after lithotritry, 1064  
 danger of in lithotritry, 1066  
 incontinence of urine from, 1084  
 retention of urine from, 1083  
 from enlarged prostate, 1083  
 calculus in, 1031. *See* Calculus  
 cancer of, 1075  
 catarrh of, 1073  
 conditions of, indicating or contra-indicating operation for stone, 1065

Bladder (*continued*)—

- congenital malformations of, 1077  
 cystitis. *See* Inflammation  
 cysts of, lodging calculi, 1048  
 complicating lithotomy, 1048  
 difficulty of entering in lateral lithotomy, 1048  
 in children, 1046  
 dilatation of neck of, in lithotomy, 1041  
 median operation, 1055  
 diseases of, 1071  
 exploration of, after lithotomy, 1042;  
 lithotritry, 1064  
 extroversion of, 1077  
 fistulous openings into, 1010, 1014  
 foreign bodies in, 1020  
 functional morbid conditions of, 1079  
 atony of, 1083  
 engorgement of, 1084  
 frequent micturition, 1083  
 neuralgia, 1082  
 incontinence of urine, 1083  
 irritability of, 1080  
 paralysis of, 1082  
 retention of urine, 1084  
 spasm of, 1082  
 fungous or polypoid growths in, 1074  
 hæmorrhage from, 1076  
 hernia of, 917, 975  
 inflammation of, 1072  
 acute, 1072  
 after lithotomy, 1054  
 after lithotritry, 1064  
 chronic, 1073  
 complicating lithotritry, 1066
- injuries of, 1019
- irritable, 1080  
 causes of, 1080  
 lithotritry complicated by, 1064  
 after lithotritry, 1068  
 treatment of, 1082
- lithotomy through, above pubes, 1057  
 painful conditions of, 1082  
 position of, in children, 1046  
 puncture above pubes, 1122  
 through rectum, 1121
- rectum opening into, 1010, 1014
- rupture of, 1020
- sacculated, 1109  
 complicating lithotomy, 1048
- sounding the, 1031
- stone in, 1031. *See* Calculus
- tubercle of, 1076
- tumours of, 1074  
 cancer, 1075  
 fibrous, 1074  
 villous or vascular, 1075  
 wounds of, in lithotomy, 1051
- Blennorrhagia, 1096
- Blind fistula in ano, 986  
 piles, 995
- Blisters in chronic inflammation, 65
- Blood, buffy coat in, 32  
 calculus, 1025



Blood (*continued*)—

- characters of, in hæmorrhage from wounded vessels, 255, 266
- clot-formation of, in arrest of hæmorrhage, 256
- in arteritis, 599
- diseases of, 153. *See also* Diseases of Contagious Origin
- rheumatism and gout, 165
- scrofula, 153
- scurvy and purpura, 162
- extension of inflammation by, 40
- extravasation of. *See* Aneurism
- mixed with pus, 47
- pathology. *See* Diseases of Blood
- sources of, in hæmaturia, 1076
- vomiting of, in fracture of skull, 720

## Blood-letting, general, in acute inflammation, 65

- local, in acute inflammation, 677
- tolerance of, 66

## Blood-vessels, enlargement of, in inflammation, 23

- formation of, in granulations, in lymph, 273
- injuries of, 255. *See* Wounds of Arteries and Veins

## Boils, 304

- causes of, 304
- diagnosis from carbuncle, 304
- treatment of, 304

## Bone, abscess of, 489

- causes of, 490
- diagnosis, 489
- symptoms of, 489
- terminations, 490
- treatment of, 490

## aneurism of, 505

- diagnosis of, 505
- signs of, 505
- treatment of, 505

## bending of, 498

## bending, rebreaking, and resetting, 433

## bruising or contusion of, 411, 714

## cancer of, 503

- diagnosis of, 504
- from osteo-aneurism, 505

## signs of, 504

## treatment of, 504

caries of, 490. *See* Caries

## cystic tumours of, 501

## cysts of, 501

## dead, separation of, 494

## deformed union of, 432

## diseased callus of, 432

## diseases of, 484

## disunited fracture of, 440

## effect of aneurism on, 325

## encephaloid of, 503

## diagnosis from osteo-aneurism, 505

## enchondroma of, 501

## exfoliation of, 493

## exostosis of, 500

## fibrous tumour of, 501

Bone (*continued*)—fracture of, 411. *See* Fracture

## fragilitas, 500

## hydatids in, 502

## hypertrophy of, 487

## inflammation of, 484

## myeloid tumour of, 502

necrosis of, 493. *See* Necrosis

## new, formation of, 493

pulsatile tumour of, 505. *See* Osteo-aneurism

## rachitis or rickets, 497

## re-fracture of, 433

## scrofulous ostitis, 485

## periostitis, 486

softening of, 491, 498. *See* Mollities ossium

## suppuration of, 487

## osteo-myelitis of, 487

## circumscribed abscess of, 489

## diffuse periostitis of, 488

## syphilitic disease, 186

## trephining of, 490

## tubercle in, 485

## tumours of, 500

ulceration of, 490. *See* Caries

## united fracture of, 433

## Bony ankylosis, 585

## Bowed or bandied-legs, 599

## Bozeman's operation for urinary vaginal fistula, 1127

Brachial artery. *See* Artery, brachialBrachio-cephalic artery. *See* Artery, innominate

## Brain, abscess in, 729

## aneurism of vessels of, 377

compression of. *See* Compressionconcussion of. *See* Concussion

## contusion of, 724

## effect of ligature of carotid on, 354

extravasation on, 717, 721. *See* Extravasation

## fungous tumours of, 731

## hernia of, 721

## congenital 732

## inflammation of, traumatic, 727

## injuries of, 721, 722

## membranes of, 721

## nerves, cranial, 726

## laceration of by contrecoup, 720

## wounds of, 726

## Brasdor's operation for aneurism, 340

## Breast, abscess of, 892

## chronic, 893

## absence of, 907

## adenoid tumour of, 895

## varieties of, 896

## amputation of, 904

## mortality after, 904

## anatomical relations of, 890

## anomalies of development of, 907

## atrophy of, 895

## cancer of, 899

## age, in, 901

## axillary glands affected in, 900

- Breast, cancer of (*continued*)—  
 causes of, 901  
 caustics in, 904  
 cysts in, 899  
 compression in, 903  
 conditions for operation, 903  
 development of, 899  
 diagnosis of, 108  
 duration of, 902  
 influence of injuries, 901  
 operation for, 905  
 origin of, 899, 901  
 pain in, 899  
 prognosis of, 902  
 retraction of nipple in, 900  
 return of, 903  
 scirrhus, 899  
 secondary, 900  
 sex in, 901  
 skin implicated in, 900  
 treatment of, 902  
 ulcer of, 903  
 cartilaginous tumour of, 897  
 colloid cancer of, 901  
 cysts, in, 898  
 cystic tumours of, 898  
 diagnosis from cancer, 898  
 treatment of, 902  
 diseases of, 890  
 general pathology and diagnosis of, 891  
 in male, 906  
 method of examining breast in, 891  
 encephaloid cancer of, 900  
 fatty tumour of, 897  
 fibrous tumour of, 897  
 functional disorders of, 906  
 abnormal secretion of milk, 906  
 congestion with milk, 906  
 deficient secretion, 906  
 excessive secretion, 906  
 hydatids of, 898  
 hypertrophy of, 895  
 of fat around, 895  
 induration, chronic, of, 894  
 inflammation of, mastitis, 892  
 chronic, 893  
 of nipple and areola, 893  
 treatment of, 892  
 irritable, 894  
 mortality after amputation of, 904  
 neuralgia of, with induration of, 894  
 neuroma of, 897  
 osteoid tumour of, 897  
 physiological relations of, 890  
 recurring fibroid tumour of, 897  
 scirrhus of, 899. *See* Breast, Cancer of  
 scrofulous tumour, 893  
 sero-cystic tumour of, 895  
 supernumerary, 907  
 tumours of, 895  
 Bridle-strictures, 1103  
 Bronchi, foreign bodies in, 830  
 pressure of aneurism on, 348
- Bronchocele (*βρόγχος*, the windpipe ;  
*κήλη*, a tumour), 850  
 causes of, 852  
 cystic, 851  
 diagnosis of, 851  
 excision in, 853  
 ligature of thyroid arteries in, 852  
 pulsating, 851  
 diagnosis of, 851  
 from carotid aneurism, 353  
 simple, 850  
 terminations of, 852  
 treatment of, 852  
 Bruise. *See* Contusion  
 Bruit in aneurism, 322  
 Bubo (*βουβών*, the groin), 176  
 diagnosis, 176  
 indurated, 277  
 inoculation from, 179  
 primary, 176  
 suppuration of, 177  
 sympathetic, 177  
 treatment of, 193  
 ulceration of, 177  
 varieties of, 177  
 Bubon d'emblée, 176  
 Buchanan's operation for restoration of lip,  
 799  
 rectangular staff, 1056  
 Buffer-accidents, 464  
 Buffy coat of blood, 33  
 diagnostic value of, 34  
 Bulb of urethra, arteries of, wounded in  
 lithotomy, 1051  
 wound of, in lateral lithotomy, 1051  
 Bullets, extractor, 287  
 removal of, 287  
 wounds by, 281  
 Bunion, 315  
 chronic, 316  
 treatment of, 316  
 Burns, 292  
 amputation in, 299  
 cicatrices of, contracted, 296  
 cheloid, 290  
 diseased conditions of, 299  
 operations for, 298  
 constitutional effects of, 293  
 degrees of, 292  
 local effects of, 293  
 modes of death from, 294  
 prognosis of, 297  
 terminations of, 294  
 treatment of, 297  
 ulcer of duodenum in, 295  
 after eschar of, 298  
 Bursa patellæ, diseases of, 315  
 abscess of, 315  
 caries of patella from, 315  
 enlargement of, 315  
 inflammation of, 315  
 treatment of, 315  
 Bursæ, 313  
 cysts from, 87  
 diseases of, 313

Burse (*continued*)—

- enlargements of, 314
    - diagnosis from popliteal aneurism, 367
  - inflammation of, 314
  - situations of, 314
- Butcher's saw, 610  
Button-suture, 251

## CACHEXY, cancerous, 116

Calcaneum. *See* Os calcis

Calcification (*calc*, lime; *facio*, I make)

- of arteries, 323
- lymphatic glands, 411, 893

Calculus (*Lat.* a small stone or pebble)

- in bladder, 1031
  - age, predisposition of, 1029
  - alternating, 1023
- of blood, 1025
  - carbonate of lime, 1025
  - causes of, 1027
  - characters of, influencing choice of operation, 1067
    - chemical, 1023
    - physical, 1022
  - climate, predisposition of, 1029
  - colour of, 1027
  - compound, 1022
  - conditions of urinary organs in causing, 1030
  - consistence of, 1022
  - crushing of, 1058. *See* Lithotripsy
    - in lithotomy, 1049
  - cystine, 1024
  - definition of, 1021
  - diagnosis of, 1034
  - encysted, 1048
    - detection of, 1034
    - difficulty from, in lithotomy, 1048
  - examination of, 1027
  - extraction of, in lithotomy, 1042
    - difficulties in, 1048
    - in lithotripsy, 1063
  - facets on, 1022
  - fibrinous, 1025
  - fracture of, spontaneous, 1042
    - difficulties in lithotomy from, 1050
  - habits of life, in causing, 1029
  - hardness of, 1022
  - hereditary predisposition, 1029
  - impaction of fragments of, in urethra, 1064, 1119
  - in children, lithotomy for, 1046
  - in female, removal of, 1069
    - symptoms of, 1035, 1069
  - influence of age and sex on, 1029
  - irritable bladder from, 1081
  - large, 1022
    - removal of, 1049
      - dangers of, 1050
      - by high operation, 1050, 1057

Calculus in bladder (*continued*)—

- lithic, or uric, 1024
  - locality, predisposition of, 1029
  - nucleus of, 1022
  - number of, 1023
  - odour of, 1022
  - operations for. *See* Lithotomy and Lithotripsy
  - origin of, 1021
  - seat of, 1021
  - oxalate of lime, 1026
    - unfavourable for lithotripsy, 1067
  - pain in, 1031
  - pathological changes induced by, 1035
  - phosphatic, 1026
    - favourable for lithotripsy, 1067
    - mixed phosphates, 1027
    - phosphate of ammonia and magnesia, 1026
    - lime, 1026
  - position of, 1049
    - difficulties from, 1049
  - priapism from, 1031
  - production of, 1021
  - prolapsus ani, from, 1031
  - prostatic. *See* Diseases of Prostate
  - recurrence of, 1054
  - relative frequency of, in various countries, 1023
  - renal, 1030
  - seizure of, in lithotripsy, 1060
  - several, detection of, 1033
  - sex, predisposition of, 1029
  - shape and size of, 1022
    - difficulties from, 1049
  - silicious, 1027
  - simple, 1022
  - sounding for, 1031
  - structure of, 1022
  - symptoms of, 1031
  - tenesmus from, 1031
  - tests for, 1024
  - urate of ammonia, 1024
  - soda or lime, 1024
  - urethral. *See* Diseases of Urethra
  - urine affected by, 1031
  - uro-stealith, 1025
  - varieties of, 1024
  - weight of, 1022
  - xanthic or uric oxide, 1024
- in kidneys, 1030  
in nasal fossæ, 791
- Callisen's operation for artificial anus, 982  
Callus, 415
  - diseased, 432
  - ossification of, 415
- Canal of Nuck, hernia in, 959  
Canaliculus, slitting the, 741  
Cancellous exostosis, 500  
Cancer, 105
  - cachexia of, 116
  - causes of, 114



Cancer (*continued*)—

- age, 114
    - in relation to species, 114
  - constitutional tendency, 114
  - hereditary tendency, 114
  - injury, 115
  - local origin, 114
  - sex, 114
    - in relation to species, 114
  - caustics in, 122
  - cells of, 106
  - characters of, 106
  - cicatrizization and cicatrix of, 119
  - co-existing diseases, 117
  - colloid, 106
  - compression in, 122
  - conditions for operation, 124
    - unfavourable for, 125
  - congelation of, 123
  - course of, 117
    - arrest of, 117
    - duration of growth, 117
    - rate of, 117
    - softening of, 117
  - cyst-formation in, 111
    - death from, 121
  - diagnosis of, 108
    - from epithelial, 126
  - effects of, constitutionally, 116
    - locally, 115
  - encephaloid, 106. *See* Encephaloid
  - epithelial. *See* Epithelial Cancer
  - excision of, 126
  - gelatinous, 123
  - hard, 106
  - integumental, 119
  - juice of, 106
  - local origin of, 114
  - melanotic, 110
  - microscopic characters of, 106, 126
  - operations for, 123
  - origin of, 114
  - osteoid, 503
  - period of non-recurrence in, 124
  - prolongation of life after operation, 124
  - recurrence of, 119
  - scirrhus, 106. *See* Scirrhus
  - secondary deposits of, 119
  - situation of, 112
    - colloid, 113
    - encephaloid, 113
    - melanotic, 113
    - scirrhus, 113
    - villous, 113
  - soft, 106
  - terminations of, 118
  - treatment of, 121
  - tumour of, 107
  - ulceration and ulcer of, 118
  - varieties of, 109
- Cancer of alveolar processes, 820
- antrum, 820
  - anus, 1012
  - in axilla, 900
  - of bladder, 1075

## Cancer of bone, 503

- breast, 899. *See* Breast
  - in cheeks, 801
  - chimney-sweeper's, 1138
  - of eyeball, 770
    - intestine, obstruction from, 977
  - jaw, upper, 820
    - lower, 820
  - larynx, 845
  - lips, 800
  - lymphatic glands. *See* Morbid Growths
  - muscles, 313
  - in neck, 856
  - of nose, 783
    - oesophagus, 842
    - parotid gland, 854
    - penis, 1133
    - pharynx, 842
    - prostate, 1093
    - rectum, 1009
    - scrotum, 1138
    - skin, 112, 128
    - testis, 1155
    - tongue, 804
    - uterus, 1173
    - vagina, 1167
- Cancerous cachexy, 116
- tubercle of tongue, 804
- Cancerous polypus, 788
- Cancerous ulcer, 141
- Cancrum oris, 802
- Cannon-shot, injuries by, 232
- Capillaries, state of, in inflammation, 23, 24
- Capillary, erectile tumour, 100
- Capsular cataract, 756
- Caput obstipum (*Lat.* head turned to one side), 594
- Carbonate of lime calculus, 1025
- Carbonic acid, asphyxia from, 835
- Carbuncle (*carbo*, a coal), 302
- causes of, 303
  - diagnosis of, 304
  - prognosis of, 303
  - terminations of, 303
  - treatment of, 303
- Carcinoma (*καρκινος*, a crab), 105
- Carcinomatous stricture of oesophagus, 842
- Caries (*Lat.* rottenness), 490
- causes of, 492
  - operations for, 492
  - signs of, 491
  - structural conditions of, 491
    - in substance of bone, 491
    - on surface of bone, 491
  - syphilitic, 186
  - treatment of, 492
  - of vertebrae, 867. *See* Spine
  - worm-eaten, 491
- Carotid artery. *See* Artery, carotid
- Carpus. *See* Wrist
- Carron oil, 298
- Carte's compressor for aneurism, 330
- Cartilages, changes of in arthritis, 576
- degenerative changes in, 583

Cartilages (*continued*)—

- destruction from synovial disease, 574
- from articular caries, 580
- of larynx, necrosis of, 845
- loose, in joints, 586
- symptoms of, 586
- treatment of, 587
- results of, 587
- malignant disease of, 588
- of ribs, fractures of, 445
- ulceration of articular, 582
- diagnosis of, 584
- repair after, 584
- signs of, 584
- treatment of, 584

## Cartilaginous tumour, 97

- course of, 99
- diagnostic characters of, 97
- origin of, 99
- situation of, 98
- structural condition of, 97
- treatment of, 99
- varieties of, 99

## Castration, 1157

Cataract (*καταράκης*, a portcullis)

- in adults, 756
- infants, 761
- capsular, 756
- conditions unfavourable for extraction, 759
- congenital, 757
- complications of, 759
- displacement or couching, 760
- extraction of by flap-operation, 758
- fluid, 757
- operations for, 757
- signs of, 756
- solution and absorption, 760
- traumatic, 757

## Catarrh, vesical, symptoms of, 1073

- treatment of, 1074

Catheter (*κατὰ*, down; *ἔημι*, I send),

- female, 1105
- for lithotrity, 1063
- prostatic, 1090
- shape and curve of, 1090
- Sims', 1128
- use of, in retention from enlarged prostate, 1092
- from stricture, organic, 1106, 1110
- spasmodic, 1118
- accidents and difficulties in, 1111

## Catheterism, forcible, 1121

## Cauliflower excrescence of uterus, 1173

Caustics (*καίω*, I burn) in abscess, 63

- in bites of rapid animals, 226
- cancer, 122
- of breast, 904
- chancre, 192
- chronic inflammation, 63
- epithelial cancer, 130
- hospital gangrene, 222
- malignant pustule, 230
- nævus, 103

Caustics (*continued*)—

- in piles, 1001
- snake-bites, 229
- stricture of urethra, 1114
- ulcers, 134. *See* Ulcers
- urethral tumours, 1116
- uterine cancer, 1174

## Cautery, actual, in chronic inflammation, 63

- of bones and joints, 65, 578
- urethral tumours, 1118
- galvanic, 1129

## Cells, of cancer, 106, 126

- of cartilaginous tumour, 98
- exudation, 46
- of fatty tumour, 90
- myeloid, 99
- plastic, 42
- pus, 46
- of recurring fibroid tumours, 96

## Cellular exostosis, 500

## Cellulitis, 301

- diagnosis of, 301
- symptoms of, 301
- treatment, 302
- diffuse pelvic, after lithotomy, 1053

## Cellulo-cutaneous erysipelas, 201

## Central necrosis, 493

Cephalhæmatoma (*κεφαλή*), the head, *αἷμα*, blood), 714

## Cerebral complications of injuries of the

- head, 713. *See* Injuries of Brain, Compression, and Concussion
- irritation, 864
- nerves, injuries of, 726

## Cervical region of spinal cord, 857

- effect of wound of, 857
- vertebræ, dislocation of, 529, 859

## Chancre, 173

- diagnosis of, 173
- Hunterian, 174
- in females, 176
- indurated, 191
- inflamed, 174
- irritable, 174
- origin and progress of, 173
- phagedænic, 174
- treatment of, 193
- simple, 174
- treatment of, 192
- situations of, 176
- sloughing, 174
- treatment of, 193
- soft, 191
- specific nature of, 178
- treatment of, constitutional, 194
- local, curative, 193
- preventive, 192

- urethral, 176
- varieties of, 175

## Chancrous induration of glans, diagnosis

- from cancer, 1134

## Charbon, 229

## Cheek-compressor, 797

## Cheeks, diseases of, 801

- fissures of, 798

- Cheeks, injuries of, 801  
tumours and ulcers of, 801
- Cheiloplastic operations (χειλος, a lip ;  
πλάσσω, I form or shape), 798  
of lower-lip, 798  
of upper-lip, 799
- Cheloid (χηλη, a crab's claw ; ειδος,  
shape), 290
- Chemical causes of inflammation, 39
- Chest, hæmorrhage into, 887  
injuries of, 882  
tapping the, 818
- Chilblain, 305
- Children, incontinence of urine in, 1083  
lateral lithotomy in, 1046  
difficulties in, 1048  
mortality after, 1053  
scrofulous disease of hip-joint in, 589  
spasmodic affection of larynx in, 845  
syphilis in, 187  
tracheotomy in, 848  
umbilical hernia in, 972  
vaginal discharges in, 1096  
vertebral caries in, 868
- Chimney-sweeper's cancer, 1138
- Chloroform, 13  
administration of, 15  
in relation to age, 15  
contra-indications for, 14  
death from, 16  
in eye-operations, 772  
in hernia, 926  
influence on mortality after operations,  
inhalers for, 16  
Clover's, 16  
Snow's, 16  
in lithotrity, 1060  
in operation for squint, 772  
in operation on stricture, 1118  
phenomena or symptoms of, 14  
physiological action of, 13  
in reduction of dislocations, 515-525  
in shock, 235  
treatment of overdose of, 17
- Chopart's operation, 699
- Chord.e (χορδη, a string), 1097  
treatment of, 1102
- Choroid, diseases of, 761
- Chronic abscess, 53  
of breast, 893  
enlargement of prostate, 1086  
inflammation, 80. *See* Varieties of  
Inflammation  
laryngitis, 845  
mammary tumour, 895  
rheumatic arthritis, 575  
uterine discharges, 1102
- Cicatrices, morbid, 289  
cheloid or exuberant, 290  
contraction of, 290, 296  
deficient, 289  
division of, 298  
excessive, 290  
healthy, 274  
painful, 291
- Cicatrices (*continued*)—  
treatment of, 289. *See* Morbid Cicatrices  
ulceration of, 291
- Cicatrizatio, process of, 274
- Circulation, arrest of, a cause of gangrene,  
144  
collateral, after ligature, 333
- Circumcision, 1132
- Circumscribed traumatic aneurism, 324
- Civiale's operation of lithotrity, 1061  
lithotrite, 1063  
statistics of lithotrity, 1065  
urethrotome, 1115
- Clavicle, dislocations of, 529  
dysphagia from, 530  
excision of, 678  
fractures, 446
- Cleft palate, 814  
age for operation for, 814  
artificial palate, 817  
results of operation, 816  
staphyloraphy, 814  
for hard palate, 816
- Clergyman's sore throat, 840, 845
- Climate, influence of, on aneurism, 324  
on calculus, 1029
- Clitoris, hypertrophy of, 1166  
removal of, 1166
- Cloacæ (cloaca, a drain or sewer) in ne-  
crossed bone, 494
- Closure of jaws, 826
- Clove-hitch knot, 514
- Clover's chloroform inhaler, 16
- Club-foot, 600
- Club-hand, 597
- Coagulation in piles, 994
- Coagulum of inflammatory blood, 33  
in wounded arteries, external, 257  
internal, 257
- Cobra di capello, bite of, 228
- Coccydynia κόκκυξ, the coccyx ; οδύνη,  
pain, 466
- Coccyx, dislocation of, 550  
fracture of, 466
- Cod-liver oil in scrofula, 161  
in chronic inflammation, 74
- Cold as an anæsthetic, 18  
effects of, 300  
in hæmorrhage, 258  
in inflammation, 62
- Collateral circulation, 333
- Collapse, 232
- Collodion, 251
- Colloid (κόλλα, glue or gelatine ; ειδος,  
form) cancer, 106  
of breast, 901  
cysts, 85
- Colon, hernia of, 976  
opening of, in obstruction. *See* Anus,  
artificial  
relations of, to seat of obstruction,  
981
- Colour-blindness, 769
- Colour of parts modified by inflammation, 27



- Column nasi, restoration of, 793  
 in Indian operation, 792
- Coma (*κῶμα*, deep sleep, lethargy) from chloroform, 17  
 from compression, 725  
 in depressed fracture, 717  
 treatment of, 719, 726  
 from extravasation, 718, 725  
 treatment of, 726  
 from intracranial suppuration, 718, 725  
 treatment of, 726  
 from traumatic encephalitis, 727  
 treatment, 729
- Comminuted fracture, 412
- Complete anchylosis, 584  
 dislocation, 508  
 fistula, 986  
 inguinal hernia, 938
- Complicated dislocation, 521  
 fracture, 431
- Compound cysts, 84  
 dislocation, 518. *See* Dislocation  
 fracture, 424. *See* Fracture
- Compress, graduated, 771
- Compression in aneurism, 329  
 digital, 331  
 history of, 332  
 direct, 331  
 history of, 331  
 results of, 332  
 by flexion, 332  
 instruments, 330  
 applicability of, 331  
 degree of, 330  
 duration of, 330  
 effects of, 331  
 history of, 330  
 management of patient, 330  
 method of, 330  
 principle of, 329  
 results of, 331
- of arteries in hæmorrhage, 259  
 brain, 725  
 from depressed fracture, 717  
 treatment of, 719, 726  
 from intra-cranial suppuration, 718, 725  
 treatment of, 726  
 from traumatic encephalitis, 727  
 treatment of, 729  
 from extravasation, 718, 725  
 treatment of, 726
- axillary aneurism, 260
- in cancer, 122  
 of breast, 903
- in chronic mammary tumour, 897  
 popliteal aneurism, 368
- of spinal cord, 859, 867
- of varicose veins, 405  
 in varicocele, 1148  
 veins in hæmorrhage, 267
- Compressor, application of in aneurism, 330
- Concretions, gouty, in ear, 774  
 in meatus auditorius, 775
- Concussion of brain, 722  
 causes of, 723  
 consequences of, 723  
 diagnosis of, from compression, 725  
 pathology of, 723  
 symptoms of, 723  
 treatment of, 724  
 of spinal cord, 861. *See* Spinal Cord  
 treatment of, 866
- Condylomata (*κόνδυλος*, a swelling), 1166, 1012  
 diagnosis from piles, 997  
 in labia, 1166
- Congelation in cancer, 123
- Congenital dislocations, 526  
 classification of, 526  
 of elbow-joint, 545  
 of foot, bones of, 572  
 of fingers, 550  
 hip, 526, 560  
 of knee-joint, 565  
 of lower jaw, 529  
 shoulder, 526, 538  
 of wrist, 547  
 fissures of cheeks, 798  
 hernia of brain, 732  
 inguinal, 942  
 hydrocele, 1143  
 malformations of anus and rectum, 1014  
 of bladder, 1077  
 of penis, 1135  
 syphilis, 187. *See* Syphilis
- Congestion, 23, 146. *See* Gangrene
- Congestive inflammation, 80  
 stricture, 1118
- Conical stumps, 686
- Conjunctiva, diseases of, 742
- Conjunctivitis, gonorrhœal, 745
- Connective tissue, 43
- Constipation, in intestinal obstruction, 978
- Constitutional syphilis, 180
- Contagious gangrene, 216  
 nature of erysipelas, 203  
 ulcer or chancre, 178. *See* Chancre
- Contagious origin, diseases of, 173
- Continuous or uninterrupted suture, 250
- Contraction of arm, 597  
 of arteries from disease, 400  
 after wounds, 257  
 of cicatrices, 290  
 after burns and scalds, 296  
 in femoral coxalgia, 591, 632,  
 of fingers, 597  
 forearm, 597  
 knee-joint, 599, 615  
 muscles, 594  
 spasmodic, of sphincter ani, 1018  
 sterno-mastoid, 595  
 strabismus, 596
- Contrecoup, fracture by, 721  
 pathology of, 721
- Contused wounds, 270

Contused wounds (*continued*)—

- amputation in, 275
- causes of, 271
- characters of, 271
- effects of, 271
- gangrene in, 271
- prognosis of, 274
- reparation after, 272
- treatment of, 274

Contusion (*contundo*, I beat together), 268

- of abdomen, 907
- arteries, 256
- bones, 411, 714
- brain, 724
  - situation of, 725
  - symptoms of, 725
- causes of, 269
- course of, 269
- degrees of, 269
- effects of, 269
- diagnosis of, 269
- signs of, 269
- treatment of, 270
- eye, 734
- joints, 506
- nerves, 318
- scalp, 714
- skull, 714

## Copaiba in gonorrhœa, 1101

## Cornea, diseases of, 747

- conical, 749
- corneitis, 747
- foreign bodies in, 735
- opacities of, 748
- staphyloma of, 749
- ulcers of, 748

## Corns, 308

## Corpuscular lymph, 41

## Counter-irritants in chronic inflammation, 63, 65

## Counter-opening in abscess, 76

## Cracked nipple, 893

Cranium. *See* SkullCrepitus (*crepo*, I crackle), in fracture, 413

- in diagnosis of, 414

## Cubebs in gonorrhœa, 1101

## Cuboid bone, dislocation of, 571

- excision of, 649

## Cuneiform bone, dislocation of, 571

- excision of, 649

## Cupping in inflammation, 62

## Curvature of spine, angular, 867

- lateral, 873. *See* Spine

- posterior, 880

## Cutaneous erysipelas, 200

- syphilis, 181

- in children, 188

- tumours, 309

Cyphosis (*κύφω*, I bend), 880

## Cysticercus telæ cellulosa, 747, 750

## Cystic oxide or cystine calculus, 1024

Cystic (*κύστις*, a cyst or bladder) aden-

- ocele, 896

- bronchocele, 850

- cancer of breast, 899

## Cystic sarcocele, 1153

- sarcoma, 895

- tumours, 86

- cancerous, 111
- cartilaginous, 99
- fatty, 91
- fibrous, 96

- tumours of bone, 501

- breast, 896
- bursæ, 314, 898, 899
- cheeks, 801
- diagnosis of, 86
- eye-ball, 770
- floor of mouth, 807
- groin, diagnosis of, 964
- labia, 1167
- lips, 800
- lower jaw, 820
- neck, 855
- ovary, 853
- parotid gland, 854
- prostate, 1094
- testicle, 1153
- thyroid body, 851
- tongue, 807
- treatment of, 89
- vagina, 1169

Cystine. *See* CALCULICystitis (*κύστις*, the bladder; *itis*, denoting inflammation) 1072. *See* Bladder, inflammation ofCystocele (*κύστις*, the bladder; *κήλη*, a tumour), 917, 975

## Cysts, barren, 84

- from coalescence and dilatation of interspaces of cellular tissue, 87

- colloid, 85

- compound, 84

- course of, 89

- cutaneous, 85

- cyst-formation—barren, proliferous, 87

- dentigerous, 85

- diagnosis of, 85

- from dilatation and distension of natural cavities, 87

- of ducts, 87

- from erring cell-development, 88

- mucous, 85

- multilocular, 1174, 1176

- oily, 85

- origin of, 87

- proliferous, 84

- sanguineous, 85

- sebaceous, 87

- seminal, 85

- serous, 85

- simple, 85

- synovial, 85

- treatment of, 89

- varieties, 86

- wens, 87

- in bladder, 1034

- omentum, 933

- prostate, 1094

- spermatic cord, 1144

**D**ACRYOLITHES, 724

Dead body, poisonous effects of, 213

Day-sight, 769

Deafness, 780

Decomposing animal matters, and pyæmia, 208

Deformities, 594

Degeneration, 131

general pathology and treatment, 132

special, 133

in stumps, 687

of arterial tissue, 323

Deficient cicatrix, 289

Deformities 594

Delirium, inflammatory, 31

in encephalitis, 727

in hydrophobia, 225

in mortification, 148

pyæmic, 209

traumatic, 237. *See* Prostration with Excitement

Demarcation, line of, in gangrene, 148

Depressed fracture of skull, 716

nose, operation for, 794

Detached eyelash, 742

Determination of blood, 23

Development of lymph, 43

Diaphoretics in inflammation, 68

Diaphragm, wounds of, 976

Diaphragmatic hernia, 976

Diathesis (*διάθεσις*, arrangement or disposition), 160

hæmorrhagic, 813

lithic, 1029

scrofulous, 160

Diffused abscess, 52

aneurism, 321

arteritis, 399

inflammation, 81, 202

pelvic cellulitis, 1053

phlebitis, 407

traumatic aneurism, 324

Digital compression in aneurism, 331

Dilatation of prostate in lithotomy, 1041

of urethra in stricture, 1109

Direct inguinal hernia, 940

Disarticulations. *See* Amputations

Disease, mortality after amputations for, 639

Dislocation (*dis*, from ; *loco*, I place), 508

causes of, 570

coaptation in, 516

complete, 508

complicated, 521

complicating fracture, 431

compound, 518

congenital, 526

diagnosis of, 509

effects of, 510

extension in, 513

false joint, 522

incomplete, 508

mechanical contrivances for, 513

prognosis of, 511

recurrence of, 511

Dislocation (*continued*)—

reduction of, 513

reparation after reduction of, 510

retentive appliances after reduction of, 512

signs of, 508

treatment of, 512

unreduced dislocation, 522

diagnosis of, 524

treatment of, 524

Dislocations, special, 527

of ankle, 566

backwards, 567

causes, 568

compound, 569

treatment, 569

forwards, 567

inwards, 567

outwards, 566

signs of, 568

treatment of, 568

astragalus, 569

backwards, 569

causes of, 570

compound, 579

forwards, 569

reduction of, 570

signs of, 570

treatment, 570

unreduced, 570

atlas and axis, 872

carpal bones, 547

clavicle, 529

causes of, 530-1

scapular end of, 531

signs of, 530-1

sternal end of, 529

treatment of, 530-1

coccyx, 550

cuboid bone, 571

cuneiform bone, 571

elbow, 538

radius and ulna backwards, 538

forwards, 540

inwards, 540

outwards, 539

radius, alone, backwards, 541

forwards, 541

outwards, 541

ulna alone, backwards, 540

causes of, 543

complicated with fracture, 544

congenital, 545

compound, 545

treatment of, 545

external-latero-angular of, 538

signs of, 541

treatment of, 544

unreduced, 544

femur, 551

complicated with fracture, 560

congenital, 560

double, 560

downwards and forwards into obturator foramen, 566



Dislocations, special (*continued*)—

of femur, into obturator foramen, causes, 556

signs, 556

treatment, 557

in hip-disease, 590

upwards and forwards on pubes, 558

causes, 559

diagnosis from fracture, 559

signs, 558

treatment, 559

upwards and backwards

on dorsum ilii, 551

into ischiatic notch, 551

causes of, 553

diagnosis of, 553

signs, 552

treatment, 554

by manipulation, 555

unreduced, 559

fibula, head of, 566

lower end of, 566

foot, congenital of, 572

hand, compound of bones of, 550

hip, 551. *See* Dislocations of Femur

humerus, 532

backwards, 533

causes of, 535

complications, of, 538

treatment of, 538

compound, 537

treatment of, 538

congenital, 538

diagnosis of, 534

downwards, 532

forwards, 533

partial, 532

reduction of, 535

signs of, 533

sub-clavicular, 533

sub-coracoid, 532

sub-glenoid, 532

sub-spinous, 533

treatment of, 535

unreduced, 535

treatment of, 537

varieties of, 532

relative frequency of, 532

jaw, 527

bilateral, 527

causes of, 528

complete, 527

congenital, 529

partial, 527

reduction of, 528

signs of, 527

unilateral, 527

unreduced, 528

knee, 562. *See* Dislocations of Tibia

internal derangement of, 564

metacarpus, 548

metacarpo-phalangeal joints, 548

metatarsus 571

os calcis, 570

Dislocations, special (*continued*)

os magnum, 548

patella, 560

inwards, 560

outwards, 560

upwards, 562

vertical, 561

pelvis, 550

at sacro-iliac articulations, 550

at symphysis pubis, 550

phalangeal bones of fingers, 550

phalangeal bones of toes, 572

pisiform bone, 548

radius, 538

backwards, 541

forwards, 541

outwards, 541

radio-ulnar articulation, inferior, 545

backwards, 545

forwards, 546

sacro-iliac articulation, 550

scaphoid bone, 571

scapula, 532

semilunar bone, 548

shoulder-joint, 532. *See* Dislocations of Humerus

symphysis pubis, 550

tarsal bones, 570

thigh-bone, 551. *See* Dislocations of Femur

thumb, 549

treatment of, 549

compound, 505

treatment of, 550

tibia, 562

backwards, 562

in contraction of knee-joint,

599, 615

causes of, 564

compound, 565

congenital of, 565

forwards, 562

lateral, 562

signs of, 563

treatment of, 564

unreduced, 564

toes, 572

ulna, 540

vertebræ, 529

cervical, 529

dorsal, 529

wrist, 546

backwards, 546

causes of, 546

compound, 547

treatment of, 547

congenital, 547

forwards, 546

injuries allied to dislocation, 547

treatment of, 547

Dissecting aneurism, 322

Dissection-wounds, 213

Distal ligature for aneurism, 340 .

carotid aneurism, 352

innominate aneurism. 351

- Distal ligature (*continued*)—  
 subclavian aneurism, 353  
 Diuretics in inflammation, 68  
 Dogs, mad, bites of, 223. *See* Hydrophobia  
 Dorsal region of cord, injuries of, 857  
 of spine, effects of concussion of, 864  
 dislocations of, 859  
 wounds of, 857  
 Double amputation, 688  
 hernia, 937  
 Drainage-tubes, 78  
 in empyema, 889  
 Dressing of stump, 684  
 Dressing of wounds, in amputation, 684  
 in excision of joints, 611  
 in operations, 19  
 of incised wounds, 249  
 antiseptic, 251  
 Dropsy of antrum, 819  
 diagnosis from tumours, 820  
 puncture of, 819  
 of Fallopian tube, 1175  
 ovarian, 1174  
 Drowning, 834  
 Duct, nasal, probing the, 741  
 Ducts, tumours from distension of, 87  
 Duodenum, ulcer of, in burns, 295  
 Dupuytren's bilateral lithotomy, 1056  
 classification of burns, 292  
 enterotome, 937  
 splint, 483  
 Dura mater, fungus of, 731  
 wounds of, 721  
 Dysphagia (δύς, badly; φάγω, I eat) from  
 aortic aneurism, 348  
 from innominate aneurism, 350  
 Dyspnoea (δύς, badly; πνέω, I breathe)  
 from aortic aneurism, 348  
 from innominate aneurism, 350

**E**AR, diseases and injuries of, 773  
 ear-ache, 780  
 artificial membrana tympani, 779  
 bleeding from, 720  
 caries, 778  
 concretions in, 775  
 collapse of membrana tympani, 779  
 cysts in pinna, 774  
 deafness, 780  
 diseases of, 773  
 displacement of, 773  
 ear-speculum, 774  
 external meatus of, 774  
 fetid discharge from, 776  
 fibroid tumour of, 774  
 foreign bodies in, 773  
 fungus granulations in, 777  
 gouty concretions in, 774  
 hypertrophy of, 774  
 inflammation of, 777  
 injuries of, 773  
 necrosis, 778  
 nævus of, 774  
 otitis, 777

- Ear (*continued*)—  
 otorrhœa, 776  
 perforation of membrana tympani, 778  
 polypi in, 775  
 serous discharge from, 720  
 steatomatous tumour of, 774  
 thickening of cuticle of, 775  
 throat-deafness, 779  
 wax in meatus of, 775  
 wounds of, 773  
 Ear-scoop, 773  
 Ecchymosis (ἐκ, out; χυμός, juice), 269  
 Ecraseur (Fr. *écraser*, to crush), 806  
 removal of tongue by, 807  
 uterine polypi by, 1173  
 Ectropion (ἐκ, out; τρέπω, I turn), operation for, 737  
 Eczema of ear, 774  
 Effusion, 42  
 albuminous, 49  
 of blood, 243  
 coagulable lymph, 42  
 liquor sanguinis, 41  
 serum, 41  
 Elbow, ankylosis of, 650  
 dislocations of, 658  
 excision of, 651  
 fractures near, 455  
 compound and comminuted, 459  
 gun-shot wounds of, 289  
 wounds of, 507  
 Electrolysis, 1071  
 Elephantiasis of scrotum, 1136  
 Elongation of vulva, 840  
 Embolism (ἐμβολον, anything inserted, a plug) causes of, 145  
 a cause of gangrene, 145  
 Emphysema (ἐν, into; φνσάω, I blow), 886  
 of abdominal wall, 887  
 thoracic parietes, 886  
 from wound of lung, 882  
 treatment of, 887  
 Emprosthotonos (ἐμπροσθεν, forward; τείνω, I stretch), 236  
 Empyema (ἐν, in; πύον, pus), 888  
 drainage in, 889  
 tapping the chest in, 888  
 Encephalitis (ἐγκέφαλον, the brain; *itis*, denoting inflammation, traumatic, 727  
 causes of, 728  
 prognosis of, 728  
 structural alterations in brain, 727  
 symptoms of, 727  
 period after injury of, 728  
 treatment of, 728  
 Encephalocele (ἐγκέφαλον, the brain; κήλη, a tumour), 732  
 Encephaloid (ἐγκέφαλον, brain; εἶδος, shape) cancer, 106  
 cells of, 106  
 diagnosis of, 107  
 from aneurism, 323  
 situations of, 113

- Encephaloid cancer (*continued*)—  
   structure of, 106  
   tumour of, 107  
     number of, 113  
 Encephaloid of antrum, 821  
   bone, 503  
     diagnosis from osteo-aneurism, 505  
   breast, 900  
   eyeball, 770  
   jaw, lower, 822  
     upper, 821  
   nose, 783  
   prostate, 1093  
   testis, 1155  
   thoracic parietes, 504  
 Encephalo - osteo - aneurism (*ἐγκέφαλον*, brain; *ὀστέον*, bone; *aneurism*), 505  
 Euchondroma (*ἐν*, in; *χόνδρος*, cartilage), 97  
   course of, 99  
   diagnostic characters of, 97  
   origin of, 99  
   pulsating, diagnosis from aneurism, 505  
   situation of, 98  
   structural elements, 98  
   treatment of, 99  
   tumour of, 97  
     number of, 99  
   varieties of, 99  
   cf antrum, 820  
     bone, 501  
     cranium, 98  
     jaw, lower, 820  
       upper, 820  
     mammary gland, 897  
     muscle, 313  
     parotid gland, 854  
     phalanges, 98  
     testicle, 1155  
 Encysted (*ἐν*, in; *κύστις*, a bladder or sac), 86  
   calculus, 1034  
   hernia of tunica vaginalis, 944  
   hydrocele, 1143  
     diagnosis from inguinal hernia, 945  
   tumours. *See* Cystic tumours, 86  
 Eneinata in hernia, 935  
 Engorgement of bladder, 1084  
 Enlargement of bursæ 973  
   of cervical glands, 855  
   lymphatic glands, 411  
   prostate, 1086  
   testicle, chronic, 185, 1151  
   tonsils, 839  
 Enterocoele (*ἐντερον*, an intestine; *κήλη*, a tumour), 917  
 Entero-epiplocele (*ἐντερον*, intestine; *epiploon*, the caul; *κήλη*, a tumour), 917  
 Entero-vagina fistula, 1012  
 Enterotome (*ἐντερον*, intestine; *τέμνω*, I cut), 937  
 Entrance of air into veins, 267  
 Entropion (*ἐν*, in; *τρέπω*, I turn), operation for, 737  
 Epicanthus (*ἐπι*, on; *κανθός*, the corner of the eye), operation for, 738  
 Epididymitis (*ἐπι*, on; *ἐίδυμος*, a testicle; *itis*, denoting inflammation), 1149  
 Epiphora, 740  
 Epiphyses of bones, separation of, 456  
 Epiplocele (*epiploon*, the caul; *κήλη*, a tumour), 917  
 Epispadias (*ἐπι*, over; *σπάδων*, an eunuch), 1135  
 Epistaxis (*ἐπι*, on; *στάζω*, I drop); 781  
   treatment of, 871  
 Epithelial (*epithelium*, from *ἐπι*, on; *θάλλω*, I bud forth) cancer, 126  
   affinities, of, 130  
   amputation in, 130  
   caustics in, 130  
   cells of, 126  
   course of, 129  
   deep, 128  
   diagnosis of, 127  
     from lupus, 141  
   écraseur in, 130  
   excision of, 130  
   ligature of, 130  
   number of, 129  
   situation, 128  
   structure of, 126  
   superficial, 127  
   treatment of, 130  
   ulcer of, 129  
   cancer of anus, 1012  
   bladder, 1075  
   larynx, 845  
   lips, 800  
   nose, 783  
   œsophagus, 842  
   penis, 1134  
   pharynx, 842  
   rectum, 1009  
   scrotum, 1138  
   tongue, 805  
   vagina, 1167  
 Epithelioma, 130  
 Epulis (*ἐπι*, on; *ὄλον*, the gum), 809  
   diagnosis of, 809  
   treatment of, 809  
 Erectile tumours, 100. *See* Nævus  
   course of, 102  
   diagnosis from aneurism, 323  
   origin of, 102  
   situation of, 100  
   structure of, 100  
   treatment of, 102  
   varieties of, 100  
   of bone, 505  
   muscle, 313  
   orbit, 100  
   tongue, 807  
 Eruption of milk-teeth, 811  
 Eruptions, syphilitic, 181  
   in children, 181



Erysipelas (*ἰρύω*, I draw; *πῆλας*, near), 200

- blood origin of, 203
- blood pathology of, 203
- a cause of death after operations, 19
  - amputations, 690
  - of secondary hæmorrhage, 6868
- causes of, 205
  - external, 205
  - predisposing, 205
- cellular, 202
- cellulo-cutaneous, 200
- cutaneous, 200
- diagnosis of, from phlegmonous inflammation, 202
- epidemic, 205
- fever of, 203
- fomites, in transmitting, 205
- infection of, 203
  - area of, 205
- mucous membranes, liability to, 202
- oedematous, 202
- period of latency in, 205
- phlegmonous, 201
- prognosis of, 200. *See* Terminations
- recurrence of, 206
- simple, 200
- spontaneous production of, 206
- terminations of, 201
- traumatic, 205
- treatment of, 206
  - preventive, 206
  - remedial, 206
- of fauces, 202
- scalp, 713
- scrotum, 1136

Ether as an anæsthetic, 13

local anæsthesia by, 18

Eustachian tubes—throat-deafness, 779

Exanthemata, syphilitic, 181

Excessive cicatrix, 290

Excision (*excido*, I cut out), 606

- in aneurism by anastomosis, 105
- of bones. *See* Excisional Surgery
- bronchocele, 853
- cancer, 123
- cartilaginous tumour, 100
- myeloid or fibro-plastic tumour, 100
- clitoris, 1166
- compared with amputation, 613
  - natural ankylosis, 614
- of cysts, and cystic tumours, 89
- in ectropion, 737
- entropion, 737
- epicanthus, 738
- of epithelial cancer, 130
- erectile tumour, 103
- fatty tumour, 92
- fibro-cellular tumour, 93
- fibrous tumour, 97
  - fibro-nucleated, 97
  - recurring fibroid, 97
- iris, 755

Excision (*continued*)—

- of jaws, 822
  - lower jaw, 824
  - malar bone, 823
  - upper jaw, 822
- joints. *See* Excisional Surgery
- nævus, 104
- omentum in hernia, 933
- for osteo-cancer, 504
- of parotid-gland, 854
- piles, 999
- tongue, entire, 805
  - partial, 805
- tonsils, 839
- in trichiasis, 737
- of tumours. *See* Morbid Growths
- Excisional Surgery, 606
  - of bones, 676
  - clavicle, 678
  - fibula, 680
  - radius, 678
  - scapula, 676
    - conditions for operation, 676
    - operation, 677
    - results, 676
    - with amputation at shoulder-joint, 678
  - tibia, 680
  - ulna, 678
- of joints, 606
  - for disease, 606
    - analysis of cases, 614
    - excision compared with amputation, 613
      - natural ankylosis, 614
    - general conditions of, for excision, 608
    - results of, 614
  - joint-excision and general treatment of joint-disease, 607
  - operation of joint-excision, 610
    - after-treatment of, 611
    - instruments, and general directions for, 610
    - re-excision, 614
    - repair after excision, 613
- of special joints, 615
- of ankle-joint, 643
  - after-treatment, 644
  - conditions for excision, 643
  - operation, 644
  - results—in mortality, 645
    - of hospitals of England and Scotland, 645
    - statistics, British, 645
  - compared with amputation at ankle-joint, Pirogoff's, 646
    - Syme's, 646
  - of leg, 645
  - in state of foot, 646
    - secondary amputation, 646

Excisional surgery of elbow (*continued*)—

- of elbow-joint, 650
  - after-treatment, 652
  - average period of recovery, 654
  - conditions for excision, 650
  - operation, 651
  - re-excision, 655
  - results—in mortality, 652
    - of hospitals of England and Scotland, 653
    - statistics, British and Foreign, 653
    - compared with amputation of arm, 653
    - in natural ankylosis, 649
    - in state of limb, 653
  - secondary amputation, 655
  - typical cases of excision, 655
- of hand, metacarpal, and phalangeal bones, 667
- of hip-joint, 631
  - after-treatment, 635
  - average period of recovery, 639
  - conditions for excision, 631
  - operation, 634
    - results—in mortality, 636
    - of hospitals of England and Scotland, 638
    - statistics, British and Foreign, 637
    - compared with amputation at hip-joint, 639
    - in natural ankylosis, 631
    - in state of limb, 639
  - section of neck of femur, 639
  - trochanter-major, 635
  - typical cases of excision, 641
    - analysis of cases, 642
- of knee-joint, 615
  - after-treatment, 619
  - average frequency of successful result, 623
  - average period of recovery, 623
  - conditions for excision, 615
  - growth of limb in childhood, after, 623
  - operation, 616
  - permanency of result, 623
  - re-excision, 624
  - results—in mortality, 620
    - of hospitals of England and Scotland, 621
    - statistics, British and Foreign, 621
    - compared with amputation in thigh, 622
    - in natural ankylosis, 620
    - in state of limb, 622
  - secondary amputation, 624
  - typical cases of excision, 625
    - analysis of cases, 629
- of shoulder-joint, 656
  - after-treatment, 657
  - average period of recovery, 658
  - conditions for excision, 656

Excisional surgery (*continued*)—

- operation, 656
- results—in mortality, 657
  - of hospitals of England and Scotland, 657
  - statistics, British and Foreign, 657
  - in state of limb, 658
- typical cases of excision, 658
- of tarsal bones, 646
  - conditions for excision, 646
  - excision of astragalus, 647
    - results of, 647
  - of os-calcis, 647
    - results of, 648
    - compared with sub astragaloïd amputation, 649
  - of astragalus and anterior tarsal bones, 647
  - os-calcis and astragalus, 948
  - cuboid, cuneiform, and scaphoid bones, 649
  - metatarsal bones, and toes, 649
- of wrist, 660
  - after-treatment, 665
  - conditions for excision, 660
  - operations, 661
    - Lister's operation, 663
  - results—in mortality, 666
    - of hospitals of England and Scotland, 666
    - in state of hand, 666
- for Injury, 667
  - of ankle-joint, 670
    - after-treatment, 671
    - conditions for excision, 671
    - operation, 671
    - results—in mortality, 671
      - of hospitals of England and Scotland, 671
      - compared with amputation of leg, 671
      - in state of foot, 671
  - of elbow-joint, 673
    - after-treatment, 674
    - conditions for excision, 674
    - operation, 674
    - results—in mortality, 674
      - of hospitals of England and Scotland, 675
      - compared with amputation of arm, 674
        - secondary excision, 675
  - of hip-joint, 669
    - after-treatment, 670
    - conditions for excision, 669
    - operation, 670
    - results—in mortality, 670
- of knee-joint, 667
  - after-treatment, 668
  - conditions for excision, 667
  - operation, 667
  - results—in mortality, 668

**Excisional surgery** (*continued*)—  
 of hospitals of England and Scotland, 669  
 of shoulder-joint, 671  
   after-treatment, 372  
   average period of recovery, 673  
   conditions for excision, 672  
   operation, 672  
   results—in mortality, 672  
     of hospitals of England and Scotland, 673  
     compared with amputation at shoulder-joint, 673  
     natural cure, 673  
     secondary excision, 672  
 of wrist, 675  
   after-treatment, 676  
   conditions for excision, 675  
   operation, 676  
   results—in mortality, 676  
     of hospitals of England and Scotland, 676  
**Excoriation** (*ex*, off; *corium*, the skin)  
 ichorous, 135  
**Excrecences**, syphilitic, 1012  
**Excretory ducts** dilated, 87  
**Exfoliation** (*ex*, out; *folium*, a leaf) of bone, 494  
**Exhaustion** a cause of death after operation, 689  
**Exomphalos** (ἐξ, out of; ὀμφαλός, the navel), 970  
**Exostosis** (ἐξ, from; ὀστέον, a bone), 500  
   of cranium, 731  
   orbit, 770  
   varieties of, 500  
   treatment of, 501  
**Extension** in fracture, 419  
   in dislocation, 513  
**External ear**, 773  
   inguinal hernia, 938  
   piles, 993  
   urethrotomy, 1115  
**Extirpation** of eyeball, 770  
**Extracranial** (*extra*, outside; κράνιον, the skull) aneurism, 355  
**Extraction** of cataract, 758. *See* Cataract  
**Extravasation** (*extra*, outside; *vas*, a vessel) of blood, 269  
   in abdomen, 908  
   diffuse aneurism, 321  
   eye, 734  
   fractures, 415  
   in pleura, 882, 887  
   skull, 718, 720, 721  
   of fæces, 927  
   urine, 1123  
**Extroversion** (*extrorsum*, outwards; *verto*, I turn) of bladder, 1077  
**Exuberant cicatrix**, 290  
**Exudation cells**, 46  
**Eyebrows**, wounds of, 733  
**Eyelashes**, diseased states of, 736, 737  
   lice in roots of, 739

**Eyelids**, nævi of, 739  
   operations on, 738  
   tumours of, 739  
   wounds of, 733  
**Eye**, contusion of, 734  
   diseases of eyeball, 769  
   extirpation of, 770  
   foreign bodies in, 735  
   injuries of, 733  
   rupture of, 735  
   syphilitic disease of, 185  
   wounds of, 373

**FACE**, cheiloplastic operations, 798  
   deformities of, 594  
   fracture of bones of, 441  
   nævi of, 103  
   paralysis of, from intracranial aneurism, 356  
   wounds of arteries of, 795, 801  
**Facets** of calculi, 1094  
**Fæcal fistula**, 937  
**Fæces**, extravasation of, 927  
**Fallopian tube**, dropsy of, diagnosis from ovarian dropsy, 1175  
**False aneurism**, 321  
   joints, 433  
     causes of, 435  
     effects of, 435  
     terminations of, 436  
     treatment of, 437  
     passages in urethra, 1111  
**Fascia propria** of femoral hernia, 960  
**Fatty degeneration** of arteries, 323  
   tumour, 90  
     cells of, 90  
     course of, 92  
     diagnosis from cysts, 91  
     in cheek, 801  
     in crural canal, diagnosis from femoral hernia, 964  
     neck, 856  
     origin of, 91  
     of parotid gland, 854  
     situation of, 91  
     structure of, 90  
     of tongue, 807  
     treatment of, 92  
     varieties of, 91  
**Fauces**, erysipelas of, 202  
**Female catheter**, 1012, 1128  
**Female genital organs**, diseases of, 1164  
**Female**, calculus in the, 1068  
   chancre in, 176  
   congenital hernia in, 959  
   diseases of genital organs of, 1164  
   gonorrhoea in, 1102  
   inguinal hernia in, 941  
   lithotomy in, 1070  
   lithotripsy in, 1070  
**Femoral artery**. *See* Artery, Femoral  
   hernia, 959. *See* Hernia  
**Femur**, dislocations of, 551  
   in hip-disease, 590



- Femur** (*continued*)—  
 excision of head of, 634  
   for disease, 630  
   injury, 669  
   results of, 636, 670  
 fractures of, 466. *See* Fractures  
 section of neck, 639
- Ferguson's operation** of staphyloraphy, 815
- Fever** of erysipelas, 81, 203  
 of gangrene, 148  
 hectic, 55  
 inflammatory, 31  
   acute, 80  
   asthenic, 79. *See* Inflammation,  
     asthenic  
   chronic, 80  
   sthenic, 79. *See* Inflammation,  
     sthenic,  
   of pyæmia, 209
- Fibrine**, deposit of, in aneurism, 326  
 increase of, in inflammation, 34
- Fibrinous** calculous, 1025
- Fibrinous lymph**, 41
- Fibro-cellular tumour**, 92  
 course of, 93  
 diagnostic characters of, 92  
 origin of, 93  
 situation of, 93  
 structure of, 92  
 treatment of, 93
- Fibrous ankylosis**, 585  
 tumour, 95  
 course of, 96  
 diagnostic characters of, 95  
 origin of, 95  
 situation of, 95  
 structure of, 95  
 treatment of, 97  
 varieties of, 96
- Fibro-calcareous tumour**, 96
- Fibro-cystic tumour**, 96
- Fibro-nucleated tumour**, 96
- Fibroid tumour**, recurrent, 96
- Fibrous polypus**, of nose, 788
- Fibrous tumour** of anus, 1012  
   breast, 897  
   ear, 774  
   jaws, 820  
   neck, 856  
   ovary, 1174  
   parotid gland, 854  
   testicle, 1155  
   uterus, 1170
- Fibro-plastic tumour**, 99  
 of bone, 502  
   jaws, 820  
   penis, 1135
- Fibrous stricture** of cesophagus, 842  
 of rectum, 1007
- Fibro-vascular tumour** of skin, 100
- Fibula**, dislocations of, 566  
 excision of, 680  
 fractures of, 487
- Fingers**, amputation of, 691
- Fingers** (*continued*)—  
 congenital deformity of, 593  
 contractions of, 597  
 dislocation of, 548  
 excision of, 667  
 fractures of, 463
- Fissure** of anus, 991  
 cheeks, 798  
 lip, 795. *See* Hare-lip  
 nose, 784  
 tongue, 804
- Fistula** (*Lat.* a pipe), 53  
 aerial, 830  
 in ano, 986  
   blind external, 987  
     internal, 987  
   complete, 986  
   diagnosis of, 987  
   extent of, 987  
   incomplete, 986  
   operation on, 988  
   treatment of, 988  
 entero-vaginal, 1012  
 fecal, 937  
 lachrymal, 740  
 penile, 1125  
 perineal, 1125  
 rectal, 1010  
 recto-vaginal, 1011  
   with lacerated perinæum, 1012  
 recto-vesical, 1010  
 salivary, 801  
 scrotal, 1125  
 urethral-vaginal, 1128  
 urinary, 1125  
 urinary vaginal, 1127  
 uterine, 1127  
 vesico-uterine, 1128  
 vesico-vaginal, 1127
- Flap-amputation**, ordinary, 681  
 Carden's, 684  
 Teale's, 684
- Flap-operation** for cataract, 758
- Flaps**, formation of, in amputation. *See*  
 Amputations, particular, 690  
   rectangular, 684
- Flat-foot**, 604
- Flexion** in aneurism, 332  
 in popliteal aneurism, 368
- Fluid** in hernial sac, 915
- Fluid tumours**, diagnosis of, from aneu-  
 rism, 323
- Fœtus**, syphilis of, 188
- Fomentations** in inflammation, 62
- Food**, administration of, in cut-throat, 829
- Foot**, amputation of, 697  
 deformities of, 600. *See* Talipes  
 dislocations of, 566  
 excision of bones of, 646  
 fractures of, 483  
 ganglionic tumours of, 315, 317  
 gunshot wounds of, 388
- Forceps**, artery, 260  
 bone, 496  
 bullet, 287

Forceps (*continued*)—

- lithotomy, 1038, 1041
- for necrosis, 496
- removal of polypi by, 788, 789
- torsion, 265
- urethral, 1119

## Forcible catheterism, 1121

- dilatation or rupture of stricture, 1112

## Forearm, amputation of, 693

- aneurisms in, 360
- arteries of, wounded, 361
- contraction of muscles of, 597
- deformities of, 597
- dislocations of, 538
- excision of bones of, 678
- ligature of arteries of, 384
- fractures of, 457

Foreign bodies in air passages, 830. *See*

## Air-passages

- in bladder, 1020
- brain, 726
- chest, removal of, 885
- contused and lacerated wounds, 274
- ears, 773
- eye, 735
- food-passages, 836
  - removal of, 837
- gunshot wounds, 279
- hernial sac, 916
- incised wounds, 248
- nose, 781
- punctured wounds, 278
- rectum, 1013
- urethra, 1119
  - removal of, 1119
- vagina, 1166

## Fracture, 411

- amputations in, 427
- arteries wounded in, 431
- bandages in, 420, 423
- causes of, 414
- coaptation of, 419
- comminuted, 412
- complete, 412
- complicated, 431
  - treatment of, 431
- complicating dislocation, 522
- compound, 424
  - amputation, 427
  - complications of, 429
  - diagnostic character of, 424
  - prognosis of, 425
  - reduction of, 425
  - signs of, 424
  - structural condition of, 424
  - termination of, 425
  - treatment of, 425
  - union of, 425
- by contrecoup, 721
- crepitus in, 413
- deformed union in, 432
  - causes of, 432
  - diagnostic signs of, 432
  - treatment of, 433
- diagnosis of, 414

Fracture (*continued*)—

- diseased callus of, 432
- displacement in, 412
- disunited, 440
- directions of, 412
- effects of, 414
- extension and counter-extension in, 419
- false joints after, 433
  - treatment of, 437
- gangrene in, 425
- green stick, 412
- impacted, 412
- incomplete, 412
- intraepiosteal, 413
- longitudinal, 412
- maintenance of coaptation in, 418
- from muscular action, 414
- oblique, 412
- plaster of Paris bandage in, 423
- prognosis of, 417
- reduction of, 418
- refracture of, 433
- reparation after, 415
- re-setting of, 433
- signs of, 413
- simple, 411
  - treatment of, 417
  - union of, 415
- splints in, 420
- starched bandage in, 423
- transverse, 412
- treatment of, 417
- united, 433
  - causes of, 435
  - effects of, 435
  - terminations of, 436
  - treatment of, 437

Fracture of calculus in bladder. *See*

## Calculus

## Fractures, special, 441

- of acetabulum, 464
- acromion, 450
- at ankle-joint, 480
- compound, 483
- of arm, 452
- calcaneum, 483
- compound, 484
- carpal bones, 463
- cartilages of ribs, 445
- clavicle, 446
  - in children, 449
  - comminuted, 443
  - compound, 447
  - on scapular side of coraco-clavicular ligament, 446
  - sternal side of ditto, 446
- coccyx, 466
- Colles', 461
- coracoid process, 450
- coronoid process, 458
- at elbow-joint, 455
- compound, 459
- excision for, 673
- of facial bones, 441

Fractures (*continued*)—

- of femur, 466
  - in attempts to reduce old dislocations, 559
  - complicating dislocated hip, 560
- lower end of, 473
  - impacted, 473
- neck of, compound, 471
  - extracapsular, 469
    - impacted, 469
    - union of, 470
  - intracapsular, 466
    - impacted, 467
    - union of, 468
- diagnosis from rheumatic arthritis, 592
- shaft of, 471
  - compound and comminuted, 474
- through trochanter, 471
- fibula, 478
- fingers, 463
- foot, 483
- forearm, 457
  - compound, 461
- humerus, 452
  - of humerus, in attempt to reduce old dislocation, 537
  - condyles of, 456
  - head of, compound, 454
    - excision for, 454
  - impacted, of surgical neck of, 453
  - lower end of, 455
  - separation of epiphysis of, 456
  - neck of, compound, 454
    - extracapsular, 453
      - impacted, 453
    - intracapsular, 453
      - impacted, 453
  - shaft of, 454
    - above deltoid, 454
    - below deltoid, 454
    - tuberosity, great, of, 453
- hyoid bone, 443
- at knee joint, 478
- of lachrymal bone, 441
- leg, 478
  - lower jaw, 443
  - malar bone, 442
  - metacarpus, 463
  - metatarsus, 483
  - nasal bones, 441
  - olecranon, 457
- patella, 474
  - compound of, 478
  - union of, 475
- pelvis, 463
  - separation of sacro-iliac articulation, 463
  - of symphysis pubis, 463
- Pott's, 481
- of radius, 461
  - lower end of, 461
  - impacted, 462
- of radius and ulna, shafts of, 460

Fractures (*continued*)—

- of ribs, 444
  - compound, 444
  - penetration of pleura and lung, 445
  - situation of, 444
- sacrum, 465
- scapula, 449
  - acromion process of, 450
  - body of, 449
  - coracoid process of, 450
  - glenoid cavity of, 451
  - inferior angle of, 449
  - neck of, 450
- of septum of nose, 441
- skull, 715. *See* Skull
- spine, 859
- sternum, 446
  - compound, 446
- tarsal bones, 483
- tibia, 478
  - compound, 483
- toes, 483
- ulna, 457
  - coronoid process of, 458
  - union of, 459
  - olecranon process of, 457
  - union of, 457
- upper jaw, 442
- vertebrae, 859
- at wrist, 461
  - of zygoma, 442
- Fragilitas ossium (*Lat.* brittleness of bones), 500
- Freezing, anæsthesia by, 18
- Frequent micturition, 1083
- Frontal sinuses, abscess in, 795
  - polypi in, 795
- Frost-bite, 300
  - treatment of, 301
- Function modified by inflammation, 31
- Functional disease, 2
  - disorders of bladder, 1079
  - of breast, 906
  - rectum and anus, 1017
- Fungus (*Lat.* a mushroom) of brain, 722
  - of dura mater, 731
  - granulations in ear, 777
  - hæmatodes (*aiua*, blood), 110
  - of skull, 731
- Funicular portion of peritoneum, 918, 942
- Furunculus, 304
- Fusible calculus, 1027
- Fusiform (*fusus*, a spindle; *forma*, shape) aneurism, 321
- GAIT affected by spinal concussion, 864
- Galactorrhœa (γάλα, milk; ῥέω, I flow), 906
- Galvanic wire cautery, 1011
- Galvano-puncture in aneurism, 340
  - in varicose veins, 406



Ganglion (*γαγγλίον*, a knot), 317

- chronic, 317
- compound, 317
- diagnosis from aneurism, 367
- in foot, 317
- hand, 317

Gangrene (*γάγγραινα*, from *γράω*, I corrode), 142

- acute, 142
- amputation in, 151, 275, 288, 337, 427, 520
- from aneurism, 145
- aneurismal varix, 146
- arrest of, 148
- from animal poisons, 144
- arrest of circulation, 144
- arterial obstruction, 145
- arteritis, 145
- causes of, 143
- from chemical decomposing agents, 144
- chronic, 143
- cold, 143
- from conditions of the part, 147
- of blood, 144
- contagious, 216
- in contused and lacerated wounds, 271
- dry, 143
- from electricity, 144
- embolism, 145
- external agents, 143
- extravasated blood, 143
- fever of, 148
- from fibrinous coagulum in artery, 145
- fibrinous obliteration of a venous trunk, 146
- in fracture, 425
- from frost-bite, 300
- hemorrhage, 143
- heat, 144
- hospital, 216
- hot, 142
- humid, 142
- idiopathic, 143
- incisions in, 270
- from inflammation, 57, 147
- treatment of, 78, 150
- injury, 143
- internal causes, 144
- of intestine in hernia, 917
- management of, 932
- after ligature, 337, 363
- of external iliac, 364
- femoral artery, 368
- subclavian artery, 360
- causes of, 337
- period after, 337
- treatment of, 337
- from, nerve-influence, deficient, 148
- line of demarcation in, 148
- of separation in, 148
- local signs of, 142
- after operations, 19
- for aneurism, 337
- after amputations, 689

Gangrene (*continued*)—

- after rhinoplastic operations, 793
- from phlebitis, 146
- phleboliths, 146
- pressure of aneurism, 322
- on vein, 145
- pulpy, 216
- from rigidity of coats of arteries, 145, 460
- rupture, partial, of artery, 145
- senile, 145, 401
- amputation in, 402
- duration of, 401
- treatment of, 401
- separation of sloughs in, 272
- sphacelus from, 143
- from strangulation, 996
- from tight bandaging, 146
- traumatic, 143
- amputation in, 275, 427, 520
- causes of, 143
- modes of occurrence of, 143
- spreading, 151, 272, 425, 519
- symptoms of, 272
- treatment of, 149. *See* Mortification
- from varicose aneurism, 146
- varieties of, 142
- from venous obstruction, 146
- wound of a main artery, 145
- Gangrenous inflammation, 59, 271. *See* Gangrene
- phagedæna, 216
- Gases, noxious, asphyxia from, 835
- Gastrotomy (*γαστήρ*, the stomach; *τέμνω*, I cut), 981
- Gelatinous cancer, 106
- polypus, 786
- General pathology and surgery, 20
- of degenerations, 131
- diseases of the blood, 153
- of contagious origin, 173
- nervous system, 232
- nutrition, 20
- inflammation, 20
- tumours or morbid growths, 81
- ulceration and ulcers, gangrene and mortification, 134
- Genital organs, female, diseases of, 1164
- external, 1164
- ovaries, 1174
- uterus, 1169
- Genito-urinary organs, injuries and diseases of, 1019
- Genu valgum (*Lat.* bowed knee), 598
- Gland mammary. *See* Breast
- parotid. *See* Parotid
- thyroid. *See* Thyroid Gland
- Glanders, 230
- treatment of, 230
- Glands, changes in secretion of, from inflammation, 31
- lymphatic. *See* Lymphatic Glands
- tumours connected with. *See* Tumours
- Glans penis. *See* Penis

- Glaucoma** (γλαυκός, sea-green), diagnosis of, 767  
     iridectomy for, 768  
**Gleet**, 1098  
**Glossitis** (γλωσσίτις, the tongue; *itis*, denoting inflammation), 804  
**Glottis**, œdema of, 832  
     scalds of, 832  
**Glottiscope** (γλωττίς, the glottis; σκοπέω, I view), 846  
**Gluteal Artery**. *See* Artery, Gluteal  
**Gonorrhœa** (γονόρρœ, semen; ῥέω, I flow), 1096  
     cause of, 1098  
     chordee in, 1097  
     chronic, 1097  
     complications of, 1099  
     consequences of, 1100  
     diagnosis of, 1098  
     gleet in, 1098  
         contagious character of, 1098  
         treatment of, 1100  
     hæmorrhage from urethra in, 1099  
     injections in, 1101  
     irritable bladder in, 1099  
     retention of urine in, 1099  
     seat of, 1096  
     stages of, 1097  
     symptoms of, 1097  
     treatment of, 1000  
     in female, 1102  
         causes of, 1102  
         complications, 1102  
         diagnosis of, 1102  
         symptoms of, 1102  
         treatment of, 1103  
**Gonorrhœal conjunctivitis**, 1100  
     induration of penis, 1097  
     inflammation of testis, 1100  
     rheumatism, 1100  
     scleritis, 1100  
     stricture, 1117  
     warts, 1133, 1166  
**Gouges**, 492  
**Gout**, 168  
     blood, origin of, 169  
         pathology of, 169  
     causes of, hygienic, 171  
     constitutional disorder in, 169  
     detection of uric acid in blood in, method of, 170  
     diagnosis of, 168  
     symptoms of, 168  
     treatment of, 171  
         curative, 172  
         preventive, 171  
**Gouty concretions in ear**, 774  
**Granular conjunctiva**, 746  
**Granulations**, 272  
     adhesion of, 273  
     cicatization over, 274  
     process of formation of, 272  
     pus-cells, relation to, 54, 273  
     sensitivity of, 273  
     structure of, 272  
**Granulations, vascularization of**, 273  
**Green-stick fracture**, 412  
**Groin**, abscess in, from bubo, 177  
     aneurism in, 364  
     diagnosis of, 364  
**Gross, Dr.**, statistics of foreign bodies in air-passages, 832  
**Growths**. *See* Tumours  
**Gullet**. *See* Œsophagus and Pharynx  
**Gums**, diseases of, 808  
     alveolar abscess of gum-boil or parulis, 808  
     congenital hypertrophy of, 809  
     epulis, 809  
     polypus of, 810  
     vascular tumours of, 810  
**Gunpowder**, injuries from, 293  
     in Clerkenwell explosion, 273  
**Gun-hot wounds**, 278  
     amputation in, 288  
         period of, 289  
     apertures of, 281  
     arteries injured in, 278  
     of bones, 279  
     characters of, 278  
     consequences of, 284  
     course of ball, 279  
     depth of, 278  
     direction of, 279  
     effects of, 284  
     excisions in, 289. *See* Excisions for Injury  
     extent of, 278  
     foreign bodies in, 279  
         detection of, 286  
         lodgment of, 279  
         removal of, 286  
     hæmorrhage from, 282  
         arrest of, 286  
         secondary, 288  
     immediate attention to, 285  
     inflammation in, 284  
     of joints, 288  
     local applications to, 287  
     number of apertures in, 280  
     pain in, 282  
     prognosis of, 285  
     projectiles, kinds of, 282  
         motion of, 283  
         penetration of, 283  
     shock in, 284, 286  
     signs of, 280  
     textures injured in, 279  
     treatment of, 285  
     unextracted ball, 285  
     of ankle-joint, 288  
         chest, 278, 883  
         cranium, 717  
         elbow-joint, 289, 674  
         face, 442  
         femur, 474  
             neck of, 471  
         foot, 288  
         hip-joint, 288, 669  
         knee, 289, 667

Gunshot wounds (*continued*)—

- of leg, 288
- mouth, 717
- palate, 717
- pharynx, 717
- shoulder-joint, 289, 672
- wrist, 676

## Gutta-percha splints, 420

**H**ÆMATOCELE (*αἷμα*, blood; *κήλη*, a

- tumour), 1144
- causes of, 1145
- signs of, 1145
- of spermatic cord, 1146
  - diagnosis from hernia, 1146
- spontaneous, 1145
- traumatic, 1145
- treatment of, 1145
- of tunica vaginalis, 1145
  - diagnosis from hernia, 945

Hæmatoma (*αἷμα*, blood), 270Hæmaturia (*αἷμα*, blood; *οὖρον*, urine), 1076

- causes of, 1077
- diagnosis of, 1077
- source of, 1076
- treatment of, 1077

Hæmorrhage (*αἷμα*, blood; *ῥήγνυμι*, I

- break forth), 255
  - into abscesses, 47
  - in amputation, how prevented, 681
  - arrest of, 258
  - arterial, 255
    - treatment of, 258
  - from bladder, 1076
  - in complicated fracture, 431
  - constitutional effects of, 256
  - distinctive characters of, 255
  - in fracture of base of skull, 266, 720
    - vault of skull, 717
  - from gunshot wounds, 282
  - in hospital gangrene, 217
  - from incised wounds, 243
    - kidneys, 1076
  - in lateral lithotomy, 1051
    - arterial, 1051
    - secondary, 1054
    - venous, 1051
  - median lithotomy, 1056
- nasal. *See* Epistaxis
- natural arrest of. *See* Wounds of Arteries
- after operations, 19, 690
- permanent arrest of natural. *See* Wounds of Arteries
  - by operation, ditto
- from penis, 1129
  - piles, 995, 996
  - prostate, 1093
- secondary, after amputation, 685, in gunshot wounds, 288
  - after ligature, 337, 338
  - of external iliac, 364

Hæmorrhage (*continued*)—

- of subclavian, 360
- superficial femoral, 368
- causes of, 262, 688
  - constitutional, 686
  - local, 685
- periods of occurrence of, after amputation, 686
  - gunshot wounds, 288
  - after ligature, 338
- phenomena of, after amputation, 686
  - ligature, 337
- treatment of, 288, 338, 686
  - after lithotomy, 1051
  - from stumps, 685
    - suppurating aneurism, 337
- treatment of, 686
- temporary arrest of natural. *See* Wounds of Arteries
- surgical. *See* Wounds of Arteries
- after tooth-extraction, 813
- in tracheotomy, 849
- treatment of, 258
  - by acupressure, 261
    - cold, 248, 258, 686
    - compression, 259, 686
    - immediate, 259
    - mediate, 259
  - ligature, 259. *See* Ligature
    - double, 342, 346
  - torsion, 264
- from urethra, 1129
  - in gonorrhœa, 1099
- venous, 266
  - arrest of, 267
  - signs of, 266
- in purpura, 163
- scurvy, 162
- wounds of chest, 882
  - of heart, 883
  - lung, 882
  - throat, 828
  - tongue, 802
  - vagina, 1164
  - vulva, 1164
- Hæmorrhagic ulcers, 139
- Hæmorrhoids (*αἷμα*, blood; *ῥέω*, I flow), 993. *See* Piles
- Hæmothorax (*αἷμα*, blood; *θώραξ*, the chest), 887
  - treatment of, 887
- Hair, syphilitic affections of, 187
  - cysts containing, 85
- Hair-bulbs, excision of, 737
- Hamstring tendons, contractions of, 600
  - division of, 600
- Hancock's excision of ankle-joint, 644
  - sub-astragaloid amputation of foot, 702
- Hand, amputations of, 690
  - aneurism of, 360
  - arteries of, wounded, 361
  - deformities of, 597



**Hand, amputations of** (*continued*)—

- from contraction of muscles of arm, 597
- dislocations of, 546
- excision of bones of, 667
- fractures of, 463
- ganglions of, 317
- gangrene of, after ligature of subclavian, 360
- gunshot wounds of, 288
- Hanging, mode of death from, 834
- Hard cancer, 106. *See* Scirrhus
- Hare-lip, 795
  - age for operation in, 796
  - double, 795
  - operation for, 796
    - for double, 797
    - with intermaxillary bone, 797
    - by simple suture, 797
    - for single, 796
  - single, 795

**Head, diseases of**, 713

- effect of spinal concussion on, 864
- erysipelas of, 713
- injuries of, 713
- rigidity of movement of, from spinal concussion, 864
- tapping the, 732

**Head-symptoms produced by chloroform**, 14**Healing process.** *See* Incised Wound, Cicatrization, and Granulation**Healing under a scab**, 246**Health, general, influence on result of**, amputations, 688

## on result of operations, 8

**Healthy stump**, 687

## ulcer, 135

**Hearing, affected by intracranial aneurism**, 357

## in spinal concussion, 864

**Heart, action of, diminished by hæmorrhage**, 256

## examination of, before operation, 9

## influence of, on production of aneurism, 324

## rupture of, 882

## secondary abscesses, in pyæmia, 210

## wounds of, 882

**Heat, effects of**, 293

## gangrene from abstraction of, 144

## from incautious use of, 301

## generation of, in inflammation, 27

## increase of, in inflammation, 27

**Hectic**, 55

## pathology of, 55

## treatment of, 79

**Hemeralopia**, 769**Hereditary syphilis**, 187**Hernia** (*ἑρνος*, a branch), 913

## anatomical coverings of, and their structural changes in, 915

## causes of, 918

## congenital, 917

## encysted or infantile, 918

**Hernia** (*continued*)—

- containing bladder, 917, 975
- contents of sac, and their structural changes, 915
- double, 937
- entero-epiplocele, 917
- incarcerated, 922
- internal, 914
- intestinal, 917
- irreducible, 921
  - diagnosis of, from strangulated hernia, 924
  - inflamed, 922
- names of, 917
- omental, 917
- operation with opening sac, 930
  - accidents attending, 933
  - after-treatment of, 934
  - artificial anus after, 935
  - treatment of, 937
- division of stricture in, 931
- exposure of sac in, 930
- fecal fistula after, 936
- management of adhesions, 931
- gangrenous intestine, 932
- omental cysts and sacs, 933
- omentum, 932
- modes of, 929
- opening sac in, 930
- peritonitis after, 935
- reduction of intestine and omentum, 931
- seat of stricture, 931
- sloughing of sac after, 934
- statistics of, 930
- wounds of arteries in, 933
- of intestine, 933
- operation without opening sac, 934
  - conditions for, 929
  - performance of, 934
  - statistics of, 930
- radical cure of, 921
  - Wood's operation, 921
  - Wurtzer's operation, 921
- reducible, 919
- sac of, 914
  - adhesions of, 916
  - contents of, 915
  - foreign bodies in, 916
  - hydrocele of, 916
  - in strangulation, 916
  - structural changes in, 914
- signs of, 919
- situations of, 917
- strangulated, 923
  - diagnosis of, 924
  - effects of, on intestine, 916
  - operation for, 928
  - mortality after, 935
  - prognosis after, 935
- peritonitis in, 923
- reduction of, 925
  - in mass, 927
  - symptoms of, 927

**Hernia (continued)**—

- treatment of, 928
  - persistence of symptoms after, 928
  - symptoms after, 928
  - seat of stricture in, 923
  - symptoms of, 923
    - modifications of, 924. *See* Diagnosis
  - taxis in, 925
    - injuries inflicted in, 927
  - treatment of, 925
    - after operation for, 934
  - structure of, 913
  - truss for, 920
- Hernia, special forms of, 938**
- of bladder, 975
    - in females, 975
    - treatment of, 975
  - brain, 721
  - congenital, 732
  - bronchialis, 853
  - cæcal, 914
  - of colon, 976
  - diaphragmatic, 976
  - femoral, 959
    - contents of, 969
    - course of, 959
    - coverings of, 960
    - crural canal, 961
      - ring, 960
      - vessels around, 960
    - varieties in, 961
  - diagnosis of, from other tumours, 964
  - fascia propria of, 960
  - femoral sheath, 961
  - opening sac in, 969
  - operation for radical cure of, 965
    - strangulated, 963
  - relations of, 960
  - relative liability in females and males to, 960
  - saphenous opening, 962
  - seat of stricture in, 963
  - signs of, 962
  - treatment of, 965
    - irreducible, 967
    - reducible, 965
  - trusses for, 965
  - varieties of, 962
- inguinal, 938**
- canal, 939
  - complete, 938
  - congenital, 942
    - in female, 959
  - diagnosis of, 945
  - direct, 940
    - course of, 940
    - coverings of, 940
    - relations of, 940
    - seat of stricture in, 941
    - signs of, 942
  - double, 942
  - encysted, 944

**Hernia, special forms of (continued)**—

- external, 938
  - in female, 941
  - incomplete, 938
  - infantile, 944
  - interstitial, 943
  - oblique, 938
    - course of, 938
    - coverings of, 938
    - relations of, 938
    - seat of stricture in, 940
    - signs of, 941
  - operation for, congenital, 958
    - in female, 959
  - encysted, 959
  - radical cure, 950
  - strangulated, 957
    - in female, 958
  - seat of stricture in, 957
  - signs of, 941
  - treatment of, 948
    - irreducible, 957
    - reducible, 948
  - trusses for, 948
  - varieties of, 938
- lumbar, 974**
- of lungs, 886
- obturator, 974**
- omental, 917**
- perineal, 975**
- pudendal, 975**
- sciatic, 976**
- scrotal, 938**
- of tunica vaginalis, 942**
- abnormal conditions of vaginal process of, 943
  - complicated with undescended testis, 943
    - abnormal situations of, 943
  - diagnosis of, 944
  - encysted, 944
  - signs of, 944
  - treatment of, 958
- umbilical, 970**
- course of, 970
  - coverings of, 970
  - seat of stricture in, 971
  - operation for strangulated, 973
  - treatment of, 972
    - irreducible, 973
    - reducible, 972
  - trusses for, 972
- vaginal, 975**
- ventral, 973**
- Hernia testis, 1153**
- Herpes of glans and prepuce, 1099**
- Hey's amputation of the foot, 698**
- High operation of lithotomy, 1057**
- Hilton's method of opening abscesses, 76**
- Hip, amputation at, 710**
- results of, 712
- dislocations of, 551**
- excision of, 634, 669**
- gunshot wound of, 288, 669**
- morbid changes of, in disease, 538, 592**

Hip (*continued*)—

- diagnosis from sacro-iliac disease, 592
- neuralgia of, 592
- rheumatic arthritis of, 592
- section of neck of femur, 639
- wounds of, 507
- Hip-disease, 588
  - abscess in, 589, 590
  - acetabular, 588, 633
    - excision in, 635, 636
  - amputation for, 639
  - anchylosis in, 588
  - arthritic, 592
    - diagnosis of, 592
    - signs of, 592
    - treatment of, 592
  - attitude in, 589
  - diagnosis of, 590
    - from caries of spine, 590
    - sacro-iliac disease, 592
  - dislocation in, 590
  - femoral, 588, 633
    - excision in, 634
    - treatment of, 590
  - pain in, 589
  - signs of, 589
    - in second stage, 589
    - in first stage, 589
  - sinuses in, 589
  - structural conditions in, 588
  - treatment of, 950
    - of contraction, 591
- Holt's treatment of stricture, 1113
- Hordeolum, 736
- Horns, 308
- Hospitals of England and Scotland—statistics of excisions in, 621, 638, 645, 653, 657, 666, 669, 671, 673, 675, 676. (Author's collection)
- Hospital gangrene, 216
  - causative relation of constitutional and local conditions in, 220
  - constitutional disorder of, 219
  - contagion of, 221
  - course of, 217
    - in blistered surface, 218
    - contused wound, 218
    - granulating wound or ulcer, 217
    - gunshot wound, 218
    - old sore, 218
    - puncture, 218
    - stump after amputation, 217
  - diagnostic characters of, 216
  - external causes of, 221
  - infection of, 221
    - infecting distance of, 221
  - local results of, 219
  - origin of, constitutional, 220
    - local, 220
  - period of latency of, 221
  - signs of, 216
  - treatment of, 222
    - constitutional, 223

Hospital gangrene (*continued*)—

- preventive, 222
- results of, 223
- Housemaid's knee, 315
- Humerus, amputation of, 696
  - disarticulation of, for subclavian aneurism, 353
  - dislocations of, 532
  - excision of head of, 656
    - for injury, 671
  - fractures of, 452
  - tumours of head of, diagnosis from aneurism, 359
- Hunterian chancre, 174. *See* Chancre
- operation for ligature, 232
- Hydatids in bone, 502
  - breast, 898
  - muscles, 313
- Hydrarthrosis (ὕδωρ, water; ἄρθρον, a joint), 574
  - treatment of, 575
- Hydrocephalus, and Paracentesis Capitis, 732
- Hydrocele (ὕδωρ, water; κήλη, a tumour), 1138
  - congenital, 1139
    - diagnosis of, 1143
    - treatment of, 1143
  - encysted, 1143
    - diagnosis of, 1143
    - treatment of, 1144
  - of hernial sac, 916
  - neck, 855
  - spermatic cord, 1144
    - diagnosis, 1144
    - diffused, 1144
    - treatment, 1144
  - tunica vaginalis, 1139
    - diagnosis of, 1140
      - from cystic disease of testicle, 1140
    - hæmatocele, 1140
    - hernia, scrotal, 1140
- injections in, 1141
  - seton in, 1142
  - signs of, 1139
  - treatment of, 1141
  - varieties of, 1140
- Hydrophobia (ὕδωρ, water; φόβος, fear), 223
  - communicability of, 227
  - condition of wound in, 224
  - constitutional disorder in, 225
  - diagnosis of, 225
  - period of latency in animals, 227
    - in man, 226
  - symptoms of, in animals, 226
  - treatment of, 226
  - virus of, 224
- Hydrops pericardii (*Lat.* dropsy of the pericardium), tapping chest in, 389
- Hydrosarcocele (ὕδωρ, water; σὰρξ, flesh; κήλη, a tumour), 1140
- Hydrothorax (ὕδωρ, water; θώραξ, the chest), tapping chest in, 387



- Hygienic influences on production of erysipelas, 205  
     of pyæmia, 216  
     on result of amputations, 688  
     of operation, 10  
 Hymen, imperforate, 1168  
 Hyoid bone, fracture of, 443  
 Hyperæmia (*ὑπὲρ*, over; *αἷμα*, blood), local, 27  
 Hypertrophy (*ὑπὲρ*, beyond; *τρέφω*, I nourish) of bone, 487  
     of alveolar borders of jaws, 809  
     breast, 894  
     fat around, 895  
     clitoris, 1166  
     external ear, 774  
     gums, 809  
     labia, 1166  
     lips, 799  
     nose, 783  
     prepuce, 1133  
     thyroid gland, 850  
     toe-nail, 308  
     tongue, 803  
     tonsils, 839  
 Hypogastric, or high operation of lithotomy, 1057  
 Hypopyon (*ὑπὸ*, under; *πύον*, pus), 747  
 Hypospadias (*ὑποσ*, under; *σπάδων*, a eunuch), 1135  
 Hysteria, diagnosis of spinal concussion from, 865  
 Hysterical affection of eyelids, 739  
     disease of joints, 319  
     induration of mamma, 894  
     irritability of mamma, 894  
     irritability of sphincter ani, 1018  
     stricture of œsophagus, 843  
     treatment of, 843  
  
**I**CE, application of, in cancer, 123  
     in inflammation, 62  
     as an anæsthetic, 18  
 Ichorous pus, 135  
 Iliac abscess, diagnosis of, 362, 593  
     aneurism, 362  
     artery. *See* Artery, iliac  
     incision in imperforate anus, 1015  
 Ilio-sciatic dislocation, 551  
 Immediate union, 245  
 Impacted calculus in urethra, 1119  
     fracture, 412  
 Impaired vision, 762  
 Imperforate anus, 1014  
     hymen, 1168  
     rectum, 1014  
     vagina, 1168  
 Impermeable stricture, 1116  
 Impotence, 1161  
     congenital, 1161  
 In-ankle, 604  
 In-knee, 598  
 Incarcerated hernia, 922  
 Ingrown toe-nail, 307  
 Incised wound, 243  
     cause, and effects of, 244  
     reparation, materials for, 244  
     modes of, 245  
     symptoms of, 243  
     treatment of, 248  
     union of, 245  
 Incision of abscesses, 76  
     in inflammation, 63  
     of urethra, for stricture, 1121  
 Incomplete ankylosis, 534  
     dislocation, 508  
     fistula, 986  
     fracture, 412  
     hernia, 918  
 Incontinence of urine, 1083  
 Indian rhinoplastic operation, 792  
 Indolent bubo, 177  
     ulcer, 137  
 Indurated chancre, 174  
 Induration, 29  
     of chancre, 174  
     sterno-mastoid muscle, 855  
 Infantile hernia, 918, 944  
     syphilis, 187  
 Infants, tetanus in, 241  
 Infiltrating growths, 105  
 Inflamed ulcer, 136  
 Inflammation, 20  
     abscess from, 52. *See* Abscess  
     blood changes in, 32  
     buffy-coat, diagnostic value of, 34  
     production of, 33  
     chemical changes of, in, 34  
     blood-vessels in, 23  
     a cause of gangrene, 147  
     causes of, 39  
     exciting, 39  
     external, 39  
     internal, 39  
     predisposing, 39  
     changes, constituting, 26  
     coagulation of blood in, 33  
     constitutional symptoms of, 31  
     destruction of texture in, 57  
     development of lymph effused in, 43  
     diagnosis from neuralgia, 319  
     duration of, 80  
     effects of, 40  
     effusion-products, 42  
     coagulable lymph, 42  
     corpuscles, exudation, 46  
     plastic, 42  
     pathology of, 47  
     pus, 46  
     extension of, 40  
     contiguous, 40  
     continuous, 40  
     fever in, 31  
     pathology of, 36  
     function disturbed by, 31  
     gangrene from, 57. *See* Mortification  
     heat in, 27  
     diagnostic value of, 28  
     generation in, 27

*Inflammation (continued)—*

- hectic fever, 55
  - pathology of, 55
- induration after, 29
- local signs of, 27
- lymph, conditions of, 41
- membranes, false, 43
  - destructive consequences of, 44
  - reparative power of, 44
- structure of, 43
- metastasis of, 40
- pain in, 30
  - diagnostic value of, 31
  - varieties of, 30
- phenomena of, 27
- productiveness in, 41
- pus, 46
  - varieties of, 47
- redness in, 27
  - diagnostic value of, 27
  - varieties of, 27
- resolution of, 41
- softening in acute, 29
- state of circulation, local, in, 23
  - arterial and venous, 24
  - capillary, 24
- suppuration from, 52
  - pathology of, 47
  - signs and diagnosis of, 52
- swelling in, 28
  - diagnostic value of, 29
  - varieties of, 28
- symptoms of, 27
- temperature in, 27
- terminations of, 41
- textural changes in, 23
- treatment of, 60
  - constitutional, 65
    - antimony in, 69
    - blood-letting in, 65
      - conditions for, 66
      - tolerance of, 66
    - diaphoretics in, 68
    - diuretics in, 68
    - mercury in, 70
    - nutritious diet in, cod liver oil, 74
    - opium in, 67
    - purgatives in, 67
    - starvation in, 68
    - stimulants in, 72
    - tonics in, 73
  - local, 62
    - blood-letting, 62
    - cupping, 62
    - leeches, 62
    - scarification, 62
  - cold, 62
    - irrigation, 62
  - heat, 82
    - with moisture, 62
  - incisions, 63
  - irritants, 63
    - varieties of, 63
  - position of part, 63

*Inflammation (continued)—*

- removal of exciting causes, 60
- conditions, pathological, 61
- consequences, local, 75
  - abscess, 75
  - effusion, 75
  - gangrene. *See* Gangrene
  - suppuration, 75
    - sinus and fistula, 77
  - ulceration, 78
- ulceration from, 57
- urine in, 31
- varieties of, 79
- Inflammation, acute, 80
  - acute sthenic, 80
  - adhesive, 43. *See* Lymph
    - union by, 43
  - chronic, 80
  - congestive, 80
  - diffuse. *See* Erysipelas
    - in areolar tissue. *See* Cellulitis
  - diphtheritic, 81
  - erysipelatos, 81. *See* Erysipelas
  - gangrenous, 59. *See* Gangrene
  - gonorrhœal. *See* Gonorrhœa
  - hæmorrhagic, 81
  - healthy, 44
  - phlegmonous, 80
  - specific, 81
  - strumous. *See* Scrofula
  - subacute, 80
  - syphilitic. *See* Syphilis
- Inflammation of aneurismal sac, 327
  - after ligature, 337
- of areola, 894
  - areolar tissue of pelvis, 1053
- around neck of bladder, 1053
- of arteries, 399. *See* Arteritis
- bladder, 1072. *See* Bladder
  - after lithotomy, 1054
  - after lithotrity, 1064
- bone, 484
  - scrofulous, 485
  - syphilitic, 485
- brain, traumatic, 727
  - after ligature of carotid, 354
- breast, 892
- in burns, 294
- of bursæ, 314
  - bursa patellæ, 315
  - cartilage, 583
  - conjunctiva, 742
    - varieties of, 743
  - diploe, 715
  - ear, 777
  - epididymis, 1149
  - eye, 742
  - frontal sinus, 785
- in gunshot wounds, 287
- of hernial sac, 917
  - hip. *See* Hip-disease
  - intestine in hernia, 916
  - irreducible hernia, 922
  - joints, 572
    - of spine, 858

**Inflammation (continued)—**

- of knee, contraction from, 615
  - larynx, 845. *See* Laryngitis
  - lungs, after ligature of carotid, 355
  - lungs and bronchi, from foreign bodies, 831
  - lungs and pleura, after ligature of subclavian, 360
  - lymphatic glands, 410
    - vessels, 409
  - mammary gland, 892
  - medullary membrane of bone, 486
  - muscle, 312
  - nerves, 38
  - nipple, 883
  - nose, 785
  - parotid gland, 853
  - pelvis, diffused, 1053
  - periosteum, 485
  - peritoneum. *See* Peritonitis
  - pharynx, 841
  - prostate, 1085
  - sclerotica, 749
  - sheaths of tendons, 316
  - synovial membrane, 572
  - testis, 1149
    - gonorrhoeal, 1149
    - undescended, 1163
  - tongue, 804
  - tonsils, 838
  - urethra, 1095
  - veins, 407
- Inflammatory oedema of scrotum, 1136**  
 stricture, 1118
- Inflation of intestines for obstruction, 980**
- Inguinal aneurism, 364**  
 hernia. *See* Hernia
- Inhalation of calomel vapour, 195**  
 powdered nitrate of silver, 848
- Inhalers, chloroform, 16**
- Injections of caustic solution into larynx, 848**  
 of coagulating agents, in aneurism, 341
- in gonorrhoea, 1101
- hydrocele, 1141
- ovarian tumours, 1176
- subcutaneous, in neuralgia, 320
- painful jerkings of limb after joint-excision, 612
- prolonged sickness after chloroform, 612
- Injury, amputation for, 689**  
 as a cause of cancer, 115
- effects of, constitutional, 232
- shock of, 232
- Innocent tumours, 82**
- Innominate artery. *See* Artery, Innominate**  
 bones, fracture of, 463
- Insane, hematoma in ears of, 774**
- Insects, stings of, 243**
- Instruments, amputating, 680**  
 for cleft palate, 815
- compression in aneurism, 330
- excision of joints, 610

**Instruments, for excision (continued)—**

- of jaw, 822
  - for lithotomy, 1037
  - lithotrixy, 1059
  - polypus nasi, 789
  - removing bullets, 287
  - removing diseased bone, 496
  - squint-operations, 772
  - tracheotomy, 849
  - trephining, 729
- Intercostal artery. *See* Artery**
- Intermaxillary bones in hare-lip, 795**
- Internal hernia, diagnosis of, 914, 979**  
 organs, states of contraindicating operation, 8
- piles, 995
- urethrotomy, 1114
- Inter-external piles, 994**
- Interrupted suture, 250**
- Intestinal cancer, 503**  
 hernia, 943
- Intestinal obstruction, 977**  
 acute, 977
  - causes of, 977
  - symptoms of, 978
  - treatment of, 979
- Amussat's operation for, 982
- results of, 983
- Callisen's operation for, 982
- chronic, 977
  - causes of, 977
  - symptoms of, 979
  - treatment of, 979
- diagnosis of, 979
- duration of constipation in, 979
- examination per rectum, 979
- gastrotony in, 981
- inflation in, 980
- Littre's operation for, 982
- order of frequency of causative conditions in, 978
  - in advanced life, 978
  - middle life, 978
  - youth, 978
- pain in, 978
- seat of, 979
- vomiting in, 978
- Intestine, adhesions of, in hernia, 916**  
 management of, 931
- congested, in hernia, 916
- management of, 932
- constricted, in hernia, 928
- gangrenous, in hernia, 917
- management of, 932
- hernia of, 917
- inflammation of, in hernia, 922
- large, diseases of. *See* Anus, Piles, and Rectum
- malformations of, 1014
- state of, in pyæmia, 210
- wounds of, 908, 910
  - in operation for hernia, 933
  - treatment of, 911
- Intracerebral (intra, within; cerebrum, the brain) suppuration. 729**



**Intracranial** (*intra*, within; *κρανιον*, the skull) aneurism, 355  
 extravasation of blood, 718, 721  
 suppuration, 718, 729  
**Intrameningeal** (*intra*, within; *μήνυξ*, a membrane) suppuration, 718  
**Intraorbital** (*intra*, within; *orbita*, the orbit) aneurism, 356  
**Intraperiosteal** (*intra*, within; *periosteum*) fracture, 413  
**Intraspinal hæmorrhage**, 858  
**Intrathoracic** (*intra*, within; *θώραξ*, the chest) aneurism, 347  
**Intussusception** (*intus*, within; *suscipio*, I receive), diagnosis of, 979  
**Inversion of body**, for foreign substances in air-tubes, 831  
 of undescended testicle, 1163  
**Iodide of potassium** in secondary syphilis, 196  
**Iodine**, injection of, in hydrarthrosis, 575  
 in hydrocele, 1141  
 ovarian disease, 1176  
 paint, 64  
 in scrofula, 161  
**Iridides** (*ιρις*, the iris; *δέω*, I bind), 755  
**Iridectomy** (*ιρις*, the iris; *εκ*, out; *τέμνω*, I cut), 768  
 for glaucoma, 768  
**Iris**, operations on, 754  
**Iritis** (*ιρις*, the iris; *itis*, denoting inflammation), 751  
 varieties of, 751  
**Iron**, sesquichloride of, in erysipelas, 207  
 in scrofula, 161  
**Irreducible hernia**. *See* Hernia  
**Irregularities of permanent teeth**, 811  
**Irrigation**, mode of applying, 62  
**Irritable bladder**, 1080. *See* Bladder  
 mamma, 894  
 rectum, 1017  
 sphincter, 1017  
 ulcer, 136  
**Irritation**. *See* Inflammation, 24, 39  
**Irritative fever**, 37  
 traumatic delirium. *See* Prostration  
 with Excitement, 237  
**Ischiatic hernia**, 976. *See* Hernia  
**Ischio-rectal abscess**, 985  
**Issues**. *See* Seton, 64  
**Ivory exostosis**, 500  
 of cranium, 731  
 pegs for false joint, 439

**JAW**, lower, diseases of, 817  
 dislocations of, 527  
 excision of, 824  
 temporo-maxillary articulation, 827  
 fractures of, 443  
 necrosis of, 817  
 rheumatic arthritis of, 826  
 subluxation of, 527  
 tumours of, 821

**Jaw**, diseases of the (*continued*)—  
 upper, diseases of, 817  
 excision of, 822  
 fracture of, 442  
 gunshot wounds of, 442  
 necrosis of, 817  
 tumours of, 820

**Jaws**, diseases of, 817

**Joints**, amputation, at. *See* Amputation  
 for disease of. *See* Excisional Surgery  
 for injury of,  
 ankylosis of, 584. *See* Ankylosis  
 cauterization of, 578  
 changes in cartilage of, 582  
 chronic rheumatic disease of, 575  
 diseases of, 572  
 particular, 588  
 excision of. *See* Excisional Surgery  
 for disease, 606  
 injury, 667

false, 433  
 fluid collection in, 574  
 fracture extending into, 431  
 gunshot wounds of, 288  
 incisions into, 575  
 inflammation of synovial membranes  
 of, 572. *See* Synovitis  
 injuries of, 506  
 loose cartilages in, 586  
 neuralgia of, 319  
 scrofulous disease of, 579  
 sprains of, 506  
 state of, in pyæmia, 210  
 stiff, 584. *See* Ankylosis  
 suppuration in, 575  
 traumatic inflammation of, 573  
 joints most liable to, 573  
 tumours connected with, 587  
 ulceration of articular cartilages of, 582  
 wounds of, 506  
 complicating compound fracture,  
 430

**Jugular vein**. *See* Vein

**KIDNEYS**, calculi formed in, 1021  
 disease of, induced by calculus, 1030  
 disease of, from stricture, 1109  
 influence of,  
 on amputations, 688  
 on lithotomy, 1053  
 on lithotrity, 1064  
 on operations, 15  
 hæmorrhage from, 1076  
 irritation of, from lithotrity, 1064  
 rupture of, 909  
 state of, in pyæmia, 210  
**Knee-joint**, amputation at, 704  
 supra-condyloid, 706  
 ankylosis of, 585, 615  
 apparatus for treatment of, 660  
 contraction of, 599  
 chloroform in hysterical contraction of, 600

- Knee-joint, contraction of (*continued*)—  
 division of hamstring tendons  
 for, 600  
 extension in, 600  
 from inflammation, 615  
 with lateral displacement, 615  
 posterior displacement, 615  
 from ligamentous union, 615  
 treatment of, 599, 615  
 deformities of, 598  
 disease of, diagnosis from hip-disease,  
 590  
 dislocations of, 562  
 compound, 565  
 congenital, 565  
 unreduced, 564  
 excision of, for disease, 616  
 results of, 620  
 for injury, 667  
 results of, 668  
 fractures near, 478  
 gunshot wounds of, 289  
 internal derangement of, 564  
 wounds of, 507
- Knives, amputating, 680  
 concealed fistula, 989  
 hernia, 957  
 lithotomy, 1038, 1041  
 method of holding, 1034
- Knock-knee, 598
- Knot, clove-hitch, 514  
 reef, 260
- L**ABIA, abscess of, 1167  
 closure of, 1168  
 condylomata of, 1166  
 cystic tumours of, 1167  
 epithelial cancer of, 1167  
 hypertrophy of, 1166  
 rodent ulcer of, 1167  
 vascular tumour of, 1168
- Lacerated wounds, 270
- Laceration of abdominal viscera, 908  
 of arteries, 255  
 complete, 258  
 partial, 258  
 perinæum, 1164  
 soft parts complicating fracture, 431  
 urethra, 1130  
 veins, 266
- Lachrymal apparatus, diseases of, 739  
 bone, fracture of, 441  
 gland-ducts obstructed, 740  
 tumour of, 740  
 obstructions, 740  
 sac, abscess of, 741
- Lactal secretion, abnormal, 906  
 tumour. *See* Galactocoele
- Lagophthalmos, 738
- Lameness in hip-joint disease, 589  
 sacro-iliac disease 592
- Laryngeal probang, and application of, 847
- Laryngitis (λάρυγξ, the larynx; *itis*,  
 denoting inflammation), 845
- Laryngitis (*continued*)—  
 acute, 845  
 chronic, 845  
 laryngoscopic examination in, 845  
 cedematous, 832  
 treatment of, 832
- Laryngoscope (λάρυγξ, the larynx; σκοπώ,  
 I view), 845  
 history of, 845  
 laryngoscopy, 846
- Laryngotomy (λάρυγξ, the larynx; τέμνω,  
 I cut), 848  
 compared with tracheotomy, 848  
 indications for performance of, 848  
 for removal of foreign bodies, 831, 850  
 results of, 832
- Larynx, abscess near, 76  
 caries of, 845  
 diseases of, 838  
 epithelial cancer of, 845  
 foreign bodies in, 830  
 inflammation of. *See* Laryngitis  
 necrosis of, 845  
 oedema of, 832, 345  
 polypi of, 845  
 scalds of, 832  
 spasmodic affections of, 845  
 syphilitic disease of, 184  
 topical medication of, 847  
 treatment of affections of, 847  
 tumours in, 845  
 ulceration of, 184  
 wounds of, 823
- Lateral curvature of spine, 873. *See* Spin  
 operation, 1037. *See* Lithotomy
- Lateritious deposits in urine, 31
- Leeches in inflammation, 62
- Leg, amputation of, 703  
 arteries of, wounded, 370  
 traumatic aneurism of, 370  
 deformities of, 598  
 excision of bones of, 680  
 fractures of, 478  
 gunshot wounds of, 288
- Lens of eye, diseases of, 755
- Lepa, 182
- Lice, in eyelashes, 739
- Lichen, 181
- Ligaments of joints, sprains of, 506
- Ligature (*ligo*, I bind), of arteries, 370  
 accidents after, 262, 335, 686  
 in amputations, 681  
 application of, 260  
 compared with acupressure, 265  
 in continuity of the vessel, 370  
 double, 372  
 effects of, 259  
 gangrene after, 337  
 general directions for, 370  
 incision for, 371  
 materials for, 371  
 opening of sheath for, 371  
 principles of application of, 259  
 re-establishment of circulation  
 after, 333

Ligature of arteries (*continued*)—

- at seat of wound, 372
- secondary hæmorrhage after, 262
- for aneurism, 332
  - above and below sac, 334
  - accidents after, 335
  - Anel's operation of, 334
    - compared with Hunter's, 334
  - Antyllus's, 334
    - compared with Anel's and Hunter's, 334
  - Brasdor's, 340
  - on cardiac side, 332, 334
  - collateral circulation after, 333
  - compared with compression, 338
  - consequences of, 335
  - on distal side, 340
  - gangrene after, 337
  - hæmorrhage after, 337, 338
    - treatment of, 338
  - Hunter's, 332
  - indications and contraindications of, 333
  - mortality after, 338
  - needle for ligature, 371
  - recurrent pulsation after, 335
    - treatment of, 336
      - re-application of ligature, 336
  - results of, 338
  - secondary aneurism after, 336
  - signs after Hunterian operation, 334
    - after-treatment, 335
    - suppuration of sac after, 337
      - causes of, 337
      - treatment of, 338
- Ligature of aorta, abdominal, 339
  - results of, 362
  - surgical anatomy of, 386
- of arteria dorsalis pedis, 1134
- axillary artery, 382
  - surgical anatomy of, 380
  - for traumatic aneurism, 360
  - for wound, 360
- of brachial artery, 384
  - surgical anatomy of, 382
  - for traumatic aneurism, 361
  - for varicose aneurism, 361
    - wound, 361
- of carotid artery, 375
  - on cardiac side of aneurism, 354
  - on distal side of aneurism, 352
  - effects of, on brain, 351, 354
    - on lungs, 351, 455
  - external, 376
    - surgical anatomy of, 375
    - for traumatic aneurism, 358
      - wounds, 358
  - for innominate aneurism, 351
    - with subclavian, 352
  - intracranial aneurism, 358
  - intraorbital aneurism, 358
- internal, 376
  - surgical anatomy of, 376

Ligature of aorta, abdominal (*continued*)—

- for traumatic aneurism of, 358
  - wounds of, 358
- recurrence of pulsation after, 355
- secondary hæmorrhage after, 355
- suppuration of sac after, 355
- surgical anatomy of, 374
  - for wound of artery, 355
- of femoral artery, common, 392
  - results of, 366
  - surgical anatomy of, 389
  - for traumatic aneurism of, 366
    - wounds of, 366
  - superficial, 392
    - gangrene after, 368
    - in Hunter's canal, 393
    - results of, 368
    - return of pulsation after, 369
  - secondary hæmorrhage after, 369
  - surgical anatomy of, 389
  - in traumatic aneurism, 366
    - wound of, 366
- of iliac artery, common, 389
  - results of, 363
  - surgical anatomy of, 386
  - external, 388
    - for aneurismal varix, 365
    - gangrene after, 364
    - recurrent pulsation after, 365
    - secondary hæmorrhage after, 364
- of iliac artery, external, for secondary hæmorrhage, 369
  - suppuration of sac after, 364
  - surgical anatomy of, 386
  - tetanus after, 364
  - for traumatic aneurism, 365
- internal, 389
  - surgical anatomy of, 386
- innominate artery, 373
  - results of, 352
  - surgical anatomy of, 372
- of lingual artery, 377
  - surgical anatomy of, 376
- peroneal artery, 399
- popliteal artery, 394
  - for aneurism, 369
  - surgical anatomy of, 393
  - for traumatic aneurism of, 369
    - wounds of, 369
- radial artery, 385
  - surgical anatomy of, 384
- subclavian artery, 379
  - for axillary aneurism, 360
  - distal, after amputation, 353
  - in first part, 359
  - for innominate aneurism, 351
    - results of, 351
    - with carotid, 352
    - results of, 352



**Ligature (continued)—**

- for subclavian aneurism, 359
- surgical anatomy of, 377
- in third part, for axillary aneurism, 369
  - gangrene after, 360
  - inflammation in chest after, 360
  - results of, 360
  - secondary hæmorrhage after, 360
- for subclavian aneurism, 353
- suppuration of sac after, 360

thyroid artery, 852

tibial artery, anterior, 396

- surgical anatomy of, 395
- dorsal in foot, 397

posterior, 397

- surgical anatomy of, 397

ulnar artery, 386

- surgical anatomy of, 385

**Ligature of aneurism by anastomosis, 105**

- of main trunk in, 105
- circumferential vessels in, 105

in cancer of tongue, 806

epithelial cancer, 130

of nævus, 104

in osseo-aneurism, 505

of pedicle of ovarian tumour, in ovariectomy, 1180

of piles, 1000

polypus of nose, 789

of rectum, 1006

uterus, 1173

vagina, 1169

prolapsus ani, 1005

tumours of urethra, 1119

**Lightning, 299**

appearances, after death from, 300

burn from, 299

prognosis in, 300

stroke of, 299

treatment of, 300

**Limbs, how affected in spinal concussion, 864**

artificial. *See* Amputations

**Linea alba, hernia through, 973**

**Lip, cancer of, 800**

excision of, 800

congenital malformations of, 798

diseases of, 799

encysted tumours of, 800

epithelial cancer of, diagnosis from chancre, 800

erectile tumours of, 801

hypertrophy of, 799

median fissure of, 795

nævus of, 800

plastic surgery of. *See* Cheiloplastic Operations, 793; and Hare-lip, 795

syphilitic cracks of, 187

ulceration of, 799

wounds of, 795

**Lipoma (Λιπωμα, fat), 91**

of nose, 783

**Liquor sanguinis, effusions of, 41**

in inflammation, 41, 48

**Lister's operation for excision of wrist, 663**

**Liston's method of holding knife in lithotomy, 1043**

**Lithectasy (Λιθοε, a stone; εκτασις, a stretching), dilatation of urethra, in female, for removal of vesical calculus, 1069**

**Lithic acid-calculi, 1024**

unfavourable for lithotripsy, 1067

diathesis, 1029

**Lithotome caché, curved double lithotome, 1056**

**Lithotomy (Λιθοε, a stone; τέμνω, I cut), 1036**

choice of operation. *See* the different operations of,

compared with lithotripsy, 1065

instruments for, 1037

operations of, 1036

preparation of patient for, 1036

recurrence of calculus after, 1054

results of, 1053

bilateral, 1056

results of, 1057

lateral, 1037

accidents during, 1050

after-treatment of, 1052

fecal fistula, 1053

impotency, 1052

incontinence of urine, 1052

morbid conditions of wound, 1052

retention of urine, 1052

urinary fistula, 1052

bruising and laceration in, 1053

causes of death after, 1053

in children, 1046

accidents in, 864

anatomical peculiarities in, 1046

difficulties in, 1046, 1048

comparative mortality in adults and children, 1053

cystitis after, 1054

difficulties in, 1048

from adherent stone, 1049

deep perinæum, 1048

from encysted calculus, 1048

enlarged prostate, 1048

in entering bladder, 1048

from enveloping folds of mucous membrane, 1049

in finding stone, 1038

from fracture of calculus, 1042, 1050

from hour-glass contraction of bladder, 1049

from position of stone, 1049

rickety deformity of pelvis, 1050

- Lithotomy, lateral (*continued*)—  
     in seizing and extracting stone, 1048  
     from shape and size of stone, 1049  
     dilatation of prostate and neck of bladder in, 1041  
     exploration of bladder after, 1042  
     extraction of stone in, 1042  
     difficulties of, 1048  
     finger, as dilator and searcher in, 1041  
     hæmorrhage after, 1054  
         during, arterial, 1051  
         venous, 1051  
     incision, external, or perinæal, in, 1040  
         deep, or prostatic, 1040  
     influence of age on, 1053  
         of shock on, 1054  
         of disease of kidneys on, 1053  
         of stone, its size and weight, 1053  
     missing urethra in, 1051  
     parts cut, and to be avoided in, 1045  
     pelvic cellulitis after, 1053  
     peritonitis after, 1054  
     position of knife in, 1040  
     prolonged, danger of, 1043  
     pyæmia after, 1054  
     removal of large calculus in, 1049  
     sloughing after, 1053  
     staff, use of, in, 1038  
     statistics of, 1053  
     straight staff in, 1044  
     wound of arteries in, 1051  
         of bladder, 1051  
         bulb in, 1051  
         rectum, 1050  
     median, 1055  
         Allarton's operation of, 1055  
         compared with lateral, 1056  
         history of, 1055  
         old, Marian operation, 1055  
         prostate, dilatation of, in, 1055  
         for prostatic calculus, 1095  
         by rectangular staff, Buchanan's operation, 1056  
         comparative estimate of, 1056  
         results of, 1056  
         for urethral calculus, 1120  
     medio-bilateral, 1057  
     quadrilateral section of prostate, 1057  
     recto-vesical, 1057  
     suprapubic, 1057  
         after-treatment of, 1058  
         indications for, 1057  
         operation, 1057  
         results of, 1058  
     urethral, 1070  
     vaginal, 1070  
 Lithotrite (*λίθος*, a stone; *tero*, I break in pieces), 1059  
     Civiale's, 1059  
 Lithotrite (*continued*)—  
     Fergusson's, 1059  
     introduction of, 1060  
     Weiss and Thompson's, 1059  
 Lithotrixy (*λίθος*, a stone; *tero*, I break in pieces), 1060  
     after-treatment of, 1063  
     anæsthetics in, 1060  
     atony of the bladder after, 1064  
     chemical composition of calculi operated on, 1068  
     compared with lithotomy, 1065  
     complicated by enlarged prostate, 1066  
     conditions influencing choice of, 1065  
         of age of patient, 1066  
         bladder, 1066  
         calculus, 1067  
         general health of patient, 1066  
         kidneys, 1066  
         prostate, 1066  
         urethra, 1066  
     constitutional disturbance from, 1064  
     crushing the stone, 1062  
         by hand pressure, 1062  
         screw pressure, 1062  
     cystitis after, 1064  
     dangers in, 1064  
     difficulties in, 1064  
     exploration of bladder after, 1064  
     in females, 1070  
     hæmorrhage in, 1064  
     history of, 1058  
     impaction of fragments of stone in urethra in, 1064  
     instruments for, 1059  
     introduction of lithotrite in, 1060  
     irritation of bladder in, 1064  
     contraindicating, 1066  
     operation of, 1060  
     preparation of patient for, 1060  
     recurrence of calculus after, 1068  
         average frequency of, 1068  
         treatment of, 1068  
     results of, and as compared with lithotomy, 1065  
     searching for stone in, 1060  
     selection of operation, lithotomy or lithotrixy, 1065  
     spasmodic retention of urine after, 1064  
     suppression of urine after, 1064  
     seizure of stone in, 1060  
     Brodie's method of, 1060  
     Civiale's method of, 1061  
     Coulson's method of, 1062  
     Skey's method of, 1060  
     Thompson's method of, 101  
     statistics of, 1065  
     using lithotrite, as held and worked by Fergusson, in, 1063  
     washing bladder after, 1063  
 Littré's operation, 982  
 Liver, rupture of, 909

**Liver (continued)—**

- state of, in pyæmia, 210
- Lobular induration of breast, 894
- Local anæsthesia, 18
  - syphilis, 173
- Lock-jaw, 236
- Longitudinal fracture, 412
- Long-sight, 769
- Loose cartilages, 586
- Lordosis (*Λορδῶς*, curved), 880
- Lucifer-match disease, 817
- Lumbar incision in imperforate anus, 1015
  - intestinal obstruction, 982
  - region, hernia in, 974
  - region of cord, effect of concussion of, 864
    - wounds of, 857
  - vertebræ, sprains of, 857
- Lungs, collapse of, in chest wounds, 882
  - disease of, in relation to chloroform, 15
    - to operations, 9
  - effect of ligature of carotid on, 355
  - hernia of, 886
  - pressure on, by aortic aneurism, 348
  - rupture of, 882
  - state of, in pyæmia, 210
  - wounds of, 883
    - complications of, 883
    - empysema from, 886
      - treatment of, 887
    - from fractured ribs, 445
    - hæmorrhage from, 882, 883
      - treatment of, 885
    - pleurisy and empyema from, 888
      - treatment of, 888
    - pneumonia from, 885
    - pneumothorax from, 886
    - prognosis of, 883
    - symptoms of, 882
    - treatment of, 885
- Lupoid (*lupus*; *ελδος*, form) ulcer, 141
  - of cheek, 141, 801
  - treatment of, 141
- Lupus (*Lat.* a wolf), 783
  - of nose, 783
  - treatment of, 784
- Lymph, 41
  - absorption of, 44
  - aplastic, 41
  - cacoplastic, 41
  - causes modifying characters of, 42, 49. *See* Pathology of Effusion, 47
  - changes in, 43
  - characters of, 41
  - coagulable, 42
    - plastic cells in, 42
  - corpuscular, 41
  - deposit of, around abscess, 52
  - development of, 43
  - effusion of, 42
  - euplastic, 41
  - fibrinous, 41
  - varieties of, 41
  - vascularization of, 43
- Lymphatic glands, abscess of, 410

**Lymphatic glands (continued)—**

- of axilla, cancer of, 900
- calcification of, 411
- cancer of, 112
- chronic induration of, 411
- of groin, enlarged, diagnosis from hernia, 964
- inflammation of, 410
- of neck, enlargement of, 855
- scrofulous enlargement of, 411. *See* Scrofula
- tumours of, 411. *See* Morbid growths
- Lymphatics, inflammation of, 409
  - with erysipelas, 409
- Lymphatitis, 409
  - diffuse suppuration from, 409
  - pyæmia from, 410
- MC INTYRE'S splint, 479
- Mad animals, bites of, 223
- Malar bone, fracture of, 442
  - tumours growing from, 823
- Mal-eruption of wisdom-teeth, 811
- Male breast, diseases of, 906
- Malgaigne's statistics of amputation, 689
- Malignant polypus, 788
  - pustule, 229
  - stricture of œsophagus, 842
    - rectum, 1009
  - tumours. *See* Cancer, Encephaloid, Scirrhus, and Tumours
- Malposition of testicle, 1162
- Mammary abscess, 892
  - gland. *See* Breast
  - tumour chronic, 895
- Manipulation in aneurism, 339
  - in subclavian aneurism, 339
- Marian operation, 1055
- Mastitis, 892
- Maxilla. *See* Jaw
- Meatus of ear, concretions in, 775
- Middle meatus of nose, polypus in, 786
- Mechanical apparatus for spinal curvature, 872, 877
  - causes of inflammation, 89
- Median lithotomy, 1055. *See* Lithotomy
- Medicine, surgery a primary division of, 1
- Medio-bilateral lithotomy, 1057
- Medullary cancer, 106
- Membrane of bone, inflammation of, 486
- Melanoid cancer, 110
- Membrana tympani, artificial, 779
- Meningitis (*μηνιγίς* a membrane; *itis*, denoting inflammation), cerebral, 727
  - spinal, 861
- Mental power affected by spinal concussion, 864
- Mercury in acute inflammation, 70
  - chronic inflammation, 72
  - syphilis, 194
  - modes of administering in, 194
    - by fumigation, 195
    - inhalation, 195



- Mercury in syphilis (*continued*)—  
 by inunction, 195  
 mouth, 194  
 preparations of, 194
- Metacarpal bones, amputation of, 692  
 dislocation of, 548  
 excision of, 667  
 fractures of, 463
- Metacarpo-phalangeal joints, amputation at, 691  
 dislocation of, 548
- Metastasis (*μετά*, signifying change; *ίσσημι*, I place), 40
- Metatarso-phalangeal joints, amputation at, 697  
 dislocation at, 572
- Metatarsus, amputation at, 698  
 dislocation of, 571  
 excision of, 649  
 fracture of, 483
- Methylene, bichloride of, 18
- Micturition, increased frequency of. *See* Irritability of Bladder
- Military surgery, results of amputations in, 689  
 excisions in. *See* Excision of Joints for Injury, 667  
 tetanus in, 284
- Milk, abnormal secretion of, 906  
 abscess, 892  
 congestion with, 906  
 deficient secretion of, 906  
 excess of, 906  
 secretion of, by the male, 907  
 teeth, eruption of, 811
- Misdescent of testicle, 1163
- Misplacements of teeth, 811
- Modelling process, 247
- Moisture and warmth in inflammation, 62
- Molecular death, 134
- Mollities ossium (*Lat.* softness of bones), 498  
 causes of, 499  
 diagnosis of, 499  
 seat of, 498  
 structural changes in, 498  
 symptoms of, 499  
 termination of, 499  
 treatment of, 500  
 urine in, 499
- Morbid cicatrices, 289  
 conditions of stump, 685  
 growths, 81. *See* Tumours
- Mortality after amputation, 688  
 excision of joints and bones. *See* Excisional Surgery  
 after operation, causes of, 19
- Mortification (*mors*, death; *facio*, I make), 134. *See* Gangrene
- Mother's marks, 103
- Motor apparatus of eyeball, disease of, 769  
 power, affected in spinal concussion, 865
- Mouth, diseases of, 795  
 gangrenous disease of, 802  
 hæmorrhage from, in fractured skull, 720
- Mouth, diseases of (*continued*)—  
 scalds of, 832  
 syphilitic disease of, 184  
 in children, 188  
 wounds of, 795
- Muco-pus, 47
- Mucous membranes, erysipelas of, 202  
 inflammation of, secretions modified in, 49  
 scrofula in, 156  
 syphilis of, 183  
 in children, 188  
 polypi, 786, 1169  
 tubercle, 184
- Mulberry calculus, 1026
- Multilocular cysts, 1176
- Mummification, 401
- Mumps. *See* Parotitis
- Muscæ volitantes, 762
- Muscles of back affected in spinal concussion, 864  
 bones held in position by, 517  
 after dislocation, 512  
 contractions of. *See* Deformities  
 inflammation of, 312  
 injuries of, 309  
 repair of, 310  
 rupture of, 309  
 spasm of, after excision of joints, 612  
 fracture, 417, 423  
 sprains of, 309  
 syphilitic induration of, 312  
 tumours of, 313
- Muscular action a cause of dislocation, 510  
 of fracture, 414  
 displacement in fracture, 412
- Mydriasis, 753
- Myelitis, traumatic (*μυελός*, marrow; *itis*, denoting inflammation), spinal, 861
- Myeloid tumour (*μυελός*, marrow; *είδος*, form), 99  
 of bone, 502  
 cranium, 731  
 jaw, 820
- Myopia, 768
- Myosis, 753
- NÆVUS** (*Lat.* a mole), 103  
 cauterization in, 103  
 excision of, 104  
 galvano puncture in, 103  
 indications for treatment of, 103  
 injection of, 103  
 ligature of, 104  
 subcutaneous, 105  
 operations for, 103  
 seton in, 103  
 structure of. *See* Vascular Tumour  
 subcutaneous puncture in, 103
- Nævus of cheek, 105, 801  
 eyelids, 103, 739  
 face, 103  
 labia, 1168

**Nævus (continued)—**

- of lips, 800
- meatus urinarius, in female, 1163
- neck, 104
- nose, 103
- prepuce, 1135
- scalp, 731
- tongue, 807

**Nails, evulsion of, 307**

- hypertrophy of, 308. *See* Horns
- in-grown toe-nail, 307
- scrofulous disease of, 156
- syphilitic disease of, 187
- ulceration of matrix of, 307. *See* Onychia

**Napiform (napus, a turnip; forma, shape), cancer, 110. *See* Scirrhus**

- Nasal bones, fracture of, 441
- necrosis of, 441, 785
- duct, probing the, 741
- fossæ, foreign bodies in, 781

**Naso-pharyngeal polypus, 790****Natural ankylosis, compared with excision, 614. *See* Excisional Surgery of Special Joints****Neck, abscess of, diagnosis from carotid aneurism, 353**

- from cysts, 855
- aneurism in, diagnosis of, 349, 353
- bursæ, enlarged, in, 855
- cysts in, 855
- deformities of, 594
- enlargement of lymphatic glands in, 855
- hydrocele of, 855
- induration of sterno-mastoid muscle in, 855
- injuries and diseases of, 827
- nævus of, 104
- tumours of, 855
- diagnosis from carotid aneurism, 353

**Necrosis (νεκρός, dead), 493**

- amputation in, 497
- causes of, 494
  - constitutional, 495
  - traumatic, 494
- central, 493
  - signs of, 494
- clonæ in, 494
- consequences of, 495
- excision for, 497
- exfoliation in, 494
- extraction of sequestrum in, 495
- instruments for removing bone in, 496
- joint-disease caused by, 580
- after joint-excision, 620. *See* Re-excision
- repair in, 493
- separation of bone in, 493
- sequestrum in, 494
- signs of, 494
- superficial, 493
- in stumps, 686
- syphilitic, 186

**Necrosis (continued)—**

- treatment of, 495
- of cranial bones, 505
  - jaws, 817
  - larynx, 845
  - nasal bones, 441, 785
  - patella, 315

**Needle-operation for cataract, 760****Needles, arrest of hæmorrhage by pressure of. *See* Acupressure****Nerves, cerebral, injury of, 726**

- contusion of, 318
- diseases of, 318
- division of, 318
- effects of aneurism on, 325
  - of aortic aneurism, 348
- inflammation of, 318
- injuries of, 318
- puncture of, 318
- repair of, 318
- section of, in neuralgia, 320
- tumours on. *See* Neuroma

**Nervous irritation, contraction of muscles from, 595, 597. *See* also Talipes power affected in spinal concussion, 864**

- system, diseases of, 232
- traumatic delirium, 237

**Neuralgia (νεῦρον, a nerve; ἄλγος, pain), 319**

- causes of, 319
- diagnosis of, 319
  - from structural disease, 319
- excision of nerve in, 320
- section of nerves in, 320
- situations of, 319
- subcutaneous injection in, 320
- symptoms of, 319
- terminations of, 320
- treatment of, 320
- of bladder, 1082
- breast, 894. *See* Chronic Induration of, 320
- hip, 592
  - diagnosis from sacro-iliac disease, 593
- joints, 588
- stump, after amputation, 687
- testis, 1162

**Neuritis (νεῦρον, a nerve; itis, denoting inflammation), 318**

- causes of, 318
- symptoms of, 318
- treatment of, 319

**Neuroma (νεῦρον, a nerve), 94**

- structure of, 94
  - differential, from painful tubercle, 94
- treatment of, 95
  - excision of, 95

**Nipple, cracked, 893**

- inflammation of, 893
- retraction of, in cancer, 108, 900
- supernumerary, 907

**Nitrous oxide as an anæsthetic, 18**

- Nodes (*nodus*, a knot), 486  
 strumous, 486  
 syphilitic, 486
- Nose, abscess of, 785  
 ala of, restored, 794  
 bleeding from, 781  
     in fracture of base of skull, 720  
 calculi in, 791  
 cancer of, 783  
 caries of bones of, 785  
 closure of nostrils, 791  
 column of, restored, 794  
 depressed, operation for, 794  
 diseases of, 783  
 epithelial cancer of, 783  
 epistaxis, 781  
 fetid discharge from, 784  
 foreign bodies in, 781  
 fractures of, 441  
 injuries of, 781  
 lipoma of, 783  
 lupus of, 783  
 nævus of, 103  
 necrosis of bones of, 785  
 ozæna, 784  
     varieties of, 784  
 plastic surgery of, 791  
 plugging nares, 782  
 polypi of, 786. *See* Polypus  
 restoration of, 792  
 rhino-plastic operations, 791  
     Indian operation, 792  
 syphilitic disease of, 184, 784  
     in infants, 188  
 thickening of membrane of, 785  
 tumours of septum of, 791  
 ulcers and fissures of, 784, 785
- Nucleus of calculi, 1023
- Nutrition, diseases of, 20
- Nutrition modified by inflammation, 23
- Nyctalopia, 769
- O**BLIQUE fracture. *See* Fracture  
 inguinal hernia, 938
- Obstruction of air-passages, 830  
 intestinal. *See* Intestinal Obstruction
- Obturator artery. *See* Artery  
 foramen, dislocation into, 556  
 hernia, 974
- Occlusion of arteries, 265. *See* Arteries  
 wounds of, 255
- Edema (*oἰδῶ*, I swell) from congestion, 407  
 inflammatory, of scrotum, 1136  
 from intra-thoracic aneurism, 348  
 of larynx, 832, 845  
 from popliteal aneurism, 367  
 from venous obstruction, 146
- Edematous erysipelas, 262  
 laryngitis, 845  
     treatment of, 847  
 ulcer, 137
- Œsophagotomy (*οἰσοφάγος*, the gullet;  
*τεμνω*, I cut), 838
- Œsophagus, foreign bodies in, 836  
 dilatation and sacculation of, 844  
 diseases of,  
 injuries of, 827  
 paralysis of, 844  
 stricture of, 842  
     carcinomatous, 842  
     diagnosis of, kind of, 842  
     dysphagia in, 843  
     fibrous, 842  
     gastrotomy in, 843  
     hysterical, or spasmodic, 843  
     organic, 842  
     treatment of, 843  
 use of stomach-pump in, 844  
     for administration of food, 845  
     wounds of, 828, 836
- Olecranon, fracture, 457
- Ollier's experiments on bone-producing  
 power of periosteum, 613
- Omentum in hernia, 915  
 cysts in, 933  
 management of, 932  
 sacs or apertures in, 915  
 symptoms of, 923  
 protruded, in wounds of abdomen, 909  
     management of, 911
- Onychia (*ὄνυξ*, a nail), 307  
 malignant, 307  
 syphilitic, 187
- Open piles, 995
- Operations, 5  
 anæsthetics in, 12  
     local, 18  
 arrangements for, 11  
 assistants for, 12  
 causes of death after, 19, 688  
 chloroform in, 13  
     with shock, 235  
 conditions favourable for, 8  
     unfavourable for, 8  
 dangers attending, or consequent on, 119  
 dressing of wound after, 19  
 erysipelas after, 19, 688  
 exhaustion after, 688  
 gangrene after, 19, 688  
     hospital, after, 688  
 guidance of pathology in, 5  
 hæmorrhage after, 19, 688  
     primary and secondary, 19  
 inflammation after, 19  
 influence of general health on, 8, 688  
     of hygienic conditions on, 10, 688  
 instruments for, 12  
 pathology in, design of, 5  
     performance of, 5  
 phlebitis after, 688  
 pneumonia after, 688



- Operations (*continued*)—  
 preparation of patient for, 11  
 pyæmia after, 19, 688  
 results of, 19  
 in scrofulous and tuberculous subjects,  
 9, 161  
 shock after, 19, 688  
 tetanus after, 19, 688  
 treatment after, 19
- Ophthalmia (*ὀφθαλμός*, an eye), 742
- Ophthalmia tarsi, 736
- Ophthalmic surgery, 733  
 diseases of choroid and retina, 761  
   conjunctiva, 742  
   cornea, 747  
   eyeball, 769  
   eyelids, 736  
   iris, 751  
   lacrimal apparatus, 739  
   lens and capsule, 755  
   sclerotic, 749  
 injuries of eye, and its appendages,  
 733  
   contusion of, 734  
   foreign bodies in, 735  
   wounds of eyeball, 733  
     eyebrows, and lids,  
     733
- Ophthalmoscope (*ὀφθαλμός*, an eye;  
*σκοπεω*, I view), 765
- Opisthotonos (*ὀπισθεν*, backwards; *τεινω*,  
 I stretch), 236
- Opium in gangrene, 152  
 cancer, 132  
 indolent ulcer, 138  
 inflammation, 69  
 irritable ulcer, 136  
 phagedænic ulcer, 139
- Orbit, aneurism in, 356  
 hæmorrhage into, in fractured skull,  
 720  
 injuries of. *See* fracture of Upper  
 Jaw, 442  
 tumours in, 770
- Orchitis (*ὄρχις*, a testicle; *itis*, denoting  
 inflammation). *See* Testis, Inflammation  
 of, 1149
- Organic stricture of œsophagus, 842  
 of urethra, 1103
- Organs and regions, injuries and diseases  
 of, 731
- Organs of special sense, and their appen-  
 dages, 733
- Orthopædic (*ὀρθός*, straight; *παίδεια*, edu-  
 cation) surgery, 506
- Orthopædic, Bigg's, 606
- Os calcis, dislocation of, 570  
 excision of, 647  
 fractures of, 483  
   compound, 434
- Os magnum, dislocation of, 548
- Osseous ankylosis, 585  
 tumours, 105  
   of jaws, 820
- Ossification of arteries, 400
- Osteo aneurism (*ὀστέον*, a bone; *aneu-*  
*rism*), 505  
 amputation in, 505  
 diagnosis of, 505  
 of humerus, diagnosis from aneu-  
 rism, 359  
 ligature in, 505  
 signs of, 505  
 situation of, 505  
 structural conditions in, 505  
 treatment of, 505
- Osteo-cancer (*ὀστέον*, a bone; *cancer*),  
 503  
 diagnosis of, 504  
 forms of, 503  
 signs of, 504  
 situation of, 503  
 structure of, 503  
 in substance of bone - interstitial, 503  
 on surface of bone, 503  
 treatment of, 504  
   amputation in, 504  
   excision in, 504
- Osteo-cartilaginous (*ὀστέον*, a bone; *car-*  
*tilage*) tumour, 99
- Osteoid (*ὀστέον*, a bone; *εἶδος*, shape),  
 malignant cancer, 503
- Osteomalacia (*ὀστέον*, a bone; *μαλακός*,  
 soft), 498. *See* Mollities ossium
- Osteo-mylitis (*ὀστέον*, a bone; *μυελός*,  
 marrow; *itis*, denoting inflammation),  
 487  
 cause of, 488  
 signs of, 488  
 treatment of, 488  
   amputation in, 488  
   excision in, 488
- Osteotrite (*ὀστέον*, a bone; *τερο*, I grind),  
 492
- Ostitis (*ὀστέον*, a bone; *itis*, denoting  
 inflammation), 484  
 causes of, 486  
 consequences of, 487  
 signs of, 486  
 treatment of, 487  
 scrofulous, 485  
 syphilitic, 485
- Otalgia, 780
- Otitis (*ὠτός*, genitive of *οὖς*, the ear; *itis*,  
 denoting inflammation), 777
- Otorrhœa (*ὠτός*, genitive of *οὖς*, the ear;  
*ῥέω*, I flow), 776
- Ovarian dropsy, 1174  
 tumours, 1174  
 causes of, 1175  
 cancerous, 1174  
 cystic, 1176  
 dermoid, 1175  
 diagnosis of, 1175  
 excision of, 1177  
 fibrous, 1174  
 injection of iodine in, 1176  
 medical treatment of, 1176  
 natural course of, 1175  
 rate of growth of, 1175

- Ovarian tumours (*continued*)—  
 relative frequency of different forms of, 1175  
 spontaneous cure of, 1175  
 tapping in, 1176  
 Ovaries, absence of, 1174  
 Ovariectomy (*ovarium*, an ovary; *τέμνω*, I cut), 1177  
 conditions, favourable and unfavourable for, 1177  
 history of, 1177  
 operation of, 1179  
   after-treatment, 1181  
   instruments for, 1179  
   results of, 1181  
   selection of cases for, 1177  
 Overcrowding, 222  
   a cause of hospital gangrene  
 Oxalate of lime, calculi, 1026. *See* Calculus  
   lithotripsy in, 1067  
 Oxygen, absence of, a cause of asphyxia, 834  
 Ozæna (*ὄζω*, I smell), 784

## PAINFUL mammary tumour, 894. *See*

- Chronic Induration of Mamma  
 Painful cicatrix, 291  
 Palate, artificial, 817  
   hard fissures of, 814, 816  
   perforation in, 817  
   soft, fissures of, 814  
   staphylopharynx, 814  
     Fergusson's operation of, 815  
     results of, 816  
   tumours of velum, 841  
     abscess of velum, 841  
 Palmar arch, wounds of, 361  
 Paracentesis (*παρά*, beyond; *κεντέω*, I pierce). *See* Tapping  
   abdominis, 983  
   capitis, 732  
   thoracis, 888  
 Paralysis from concussion of spinal cord, 865  
   fracture of skull, 717  
     spine, 860  
   intra-cranial aneurism, 356  
   traumatic encephalitis, 727  
     meningitis, 727  
   wounds of spinal cord, 857  
 Paraphimosis (*παρά*, beyond; *φίμωσις*, a muzzle), 1132  
   treatment of, 1133  
 Paraplegia from fracture of spine, 860,  
   spinal concussion, 864  
   wounds of spinal cord, 857  
 Paronychia, 305  
 Parotid gland, diseases of, 850  
   division of duct of, 801  
   excision of, 854  
   inflammation of, 853  
   tumours of, 853  
     treatment of, 854  
 Parotid region, tumours in, 854

- Parotitis (*παρωτίτις*, the parotid gland; *itis*, denoting inflammation), 853  
 Parturition, laceration of perinæum in, 1164  
 Parulis, 808  
 Particular amputations, 690  
   bones, diseases of, 505  
   joints, diseases of, 588  
 Patella, caries of, 315  
   disease of, 315  
   diseases of bursa of, 315  
   dislocations of, 560  
   fracture of, 474  
 Pathological anatomy and pathology, relative guidance of, in diagnosis, etiology, and prognosis, 2  
   in design and performance of surgical operations, 5  
 Pathology and surgery, general, 20  
   special, 243  
 Pedicle of ovarian tumour, management of, 1180  
 Pelvis, diffuse cellulitis of, 1053  
   disease of, 634  
     excision of bones in, 634  
   dislocations of, 550  
   fractures of, 463  
   rickets of, difficulty from, in lithotomy, 1050  
 Penetrating wound of abdomen, 908  
   of chest, 288  
 Penile fistula, 1125  
 Penis, amputation of, 1134  
   results of, 1135  
   cancer of, 1133  
   chancres on, 176, 1134  
   diseases of, 1130  
   elephantoid growth of, 1133  
   epithelial cancer of, 1134  
   fibro-plastic tumour of, 1135  
   fistula in, 1125  
   gonorrhœal induration of, 1097  
   herpes of, 1099  
   inflammation of, 1130  
   injuries of, 1129  
   laceration of, 1129  
   malformations of, 1135  
   nævus of, 1135  
   scirrhus of, 1134  
   warts on, 1133  
   wounds of, 1129  
 Perchloride of iron in aneurism, 341  
   in bronchocele, 852  
   erysipelas, 207  
   nævus, 103  
   varicose veins, 406  
 Perforations in palate, 817  
 Pericardium, tapping the, 889  
   wounds of, 883  
 Perinæal abscess, 1124  
   fistula, 1125  
   hernia, 975  
   incision in imperforate anus, 1015  
   section, 1115  
   results of, 1116

- Perinæum, laceration of, 1164  
 consequences of, 1164  
 treatment of, 1164  
 results of, 1165  
 with recto-vaginal fistula, 1012  
 wounds of arteries of, in lithotomy, 1051
- Periosteum, contusion of, 714  
 inflammation of, 485  
 preservation of in joint-excision, 611  
 regeneration of bone by, 613
- Periostitis (*periosteum*; *itis*, denoting inflammation), 485  
 serofulous, 486  
 syphilitic, 486
- Peritonitis (*peritoneum*; *itis*, denoting inflammation), 910  
 with hernia, 917  
 after hernia operations, 935  
 after lithotomy, 1054  
 traumatic, 912
- Permanent arrest of hæmorrhage, 256  
 closure of cut arteries, 257
- Peroneal artery, 399. *See* Artery
- Petit's operation in hernia, 929
- Phagedæna (*φάγω*, I eat), gangrenous, 216  
 sloughing, 246. *See* Hospital Gangrene
- Phagedænic bubo, 177  
 chancre, 174. *See* Chancre  
 ulcer, 139
- Phalanges of fingers, dislocation, 548  
 of toes, dislocation, 572
- Pharyngitis, 841
- Pharyngotome (*φάρυγξ*, the pharynx; *τέμνω*, I cut), 838
- Pharynx, abscess behind, 841, 872  
 cancer of, 842  
 diseases of, 838  
 foreign bodies in, 836  
 inflammation of, 841  
 injuries of, 827  
 polypi in, 842  
 scalds of, 832  
 syphilitic ulceration of, 184, 842  
 tumours of, 842  
 wounds of, 828
- Phlebitis (*φλέψ*, a vein; *itis*, denoting inflammation), 407  
 adhesive, 407  
 causes of, 408  
 connexion of erysipelas with, 408  
 lymphatitis with, 409  
 pyæmia with, 210  
 diffuse, 407  
 structural conditions in, 407  
 suppurative, 407  
 symptoms of, 407  
 terminations of, 408  
 traumatic, 408  
 treatment of, 408
- Phlebolithes, 408
- Phlegmonous (*φλέγω*, I burn) erysipelas, 201
- Phlegmonous inflammation, 80
- Phosphatic calculi, 1026  
 favourable for lithotripsy, 1067  
 in relation to lithotomy, 1049
- Phosphorus, necrosis of jaws from, 817
- Phrenic nerve, effect of paralysis of, in fracture of spine, 860  
 in wound of cord, 857
- Phthisis complicating fistula in ano, 988
- Phymosis (*φυμός*, a muzzle), 1131  
 acquired, 1131  
 circumcision for, 1132  
 congenital, 1131  
 slitting prepuce for, 1131  
 treatment of, 1131
- Piles, blind, 995  
 causes of, exciting, 998  
 predisposing, 997  
 cauterization in, 1001  
 clamp in, 1002  
 coagulation in, 999  
 complications of, 997  
 constitutional treatment of, 998  
 diagnosis of, 997  
 écraseur in, 1002  
 excision of, 999  
 external, 994  
 inflammation of, 995  
 extruded, 996  
 congestion of, 996  
 hæmorrhage from, 996  
 internal, 995  
 inflammation of, 996  
 intero-external, 994  
 ligature of, 1000  
 mortification and sloughing of, 996  
 open, 995  
 operations on, 999  
 pathology of, 993  
 structure of, 994, 995  
 subsidence of, 998  
 suppuration of, 998  
 symptoms of 994, 995  
 terminations of, 998  
 treatment of, 998  
 ulceration of, 996
- Pilo-cystic (*pilus*, a hair; *κυστίς*, a cyst or bladder) tumours. *See* Cutaneous Cysts, 85; Dermoid Cysts, 1175
- Pinguicula, 747
- Pirogoff's amputation of foot, 701
- Pisiform bone, dislocation of, 548
- Plasma (*πλάσσω*, I form), 20
- Plasters, 249  
 after amputations, 635
- Plaster of Paris bandage, 423
- Plastic (*πλάσσω*, I form) lymph, 41  
 effusion in arteries, 257  
 operations on contracted cicatrices, 298
- Plastic surgery, 197  
 of eyelids, 738  
 lips, 798



- Plastic surgery (*continued*)—  
 of nose, 791  
 palate, 814  
 perinæum, 1165  
 urethra, 1126  
 vagina, 1011, 1127
- Pleura, accumulation of air in, 886  
 extravasation of blood into, 887  
 inflammation of, after ligature of sub-  
 clavian, 860  
   in injury of chest, 882  
   pus in, 885  
   tapping the, 888
- Pliers, cutting, 496
- Plugging nares, 782
- Pneumatocele (πνεῦμα, wind; κήλη, a  
 tumour), 886
- Pneumonia, congestive, 828  
   in cut-throat, 828  
   from foreign bodies, 831  
   after ligature of carotid artery, 355  
   subclavian artery, 360  
   traumatic, 882
- Pneumo-thorax (πνεῦμα, wind; θώραξ, the  
 chest), 886
- Pointing of abscess, 53
- Poisoned wounds, 223
- Poisons, blood-conditions causing gangrene,  
 144
- Pollock's operation for staphyloraphy,  
 816
- Polypus, 92  
   in bladder, 1074  
   ear, 775  
   frontal sinuses, 795  
   larynx, 847  
   nasal, 786  
     fibrous, 788  
     gelatinous, 786  
     malignant, 788  
     mucous, 786  
       diagnosis of, 787  
       removal of by boutonnière  
         palatine, 790  
         by forceps,  
           ligature, 789  
         plug-extraction, 790  
         slitting of ala, 790  
     symptoms of, 786  
     treatment of, 788  
   pharyngeal, 842  
   of rectum, 1005  
     diagnosis from piles, 997  
     species of, 1005  
   in urethra, 1118  
   uterine, 1170  
   in vagina, 1169  
     velum palati, 841
- Popliteal artery, aneurism of, 367  
   ligature of, 393
- Portal circulation, retardation of, a cause  
 of piles, 997
- Position, in inflammation, 63
- Posterior curvatures of spine, 880  
   tibial artery, ligature of, 397
- Posthitis (πόσθη, the foreskin; *itis*, de-  
 noting inflammation), 1130
- Potassa fusa in inflammation, chronic,  
 64
- Pott's fracture, 481
- Poultices, 62
- Pregnancy, influence on union of fracture,  
 417  
   in mollities ossium, 499
- Preparation of patient for operation, 11
- Prepuce, fibro-plastic growth in, 1135  
   herpes of, 1199  
   hypertrophy of, 1133  
   inflammation of, 1130  
   nævus under, 1135  
   slitting, for phymosis, 1131  
   warts on, 1133
- Presbyopia, 769
- Pressure in aneurism. *See* Compression  
   in cancer, 122  
   in chronic inflammation, 75  
   in hæmorrhage, 259
- Pressure-effects of aneurism, 325  
   of abdominal aorta, 362  
   femora lartery, 366  
   iliac arteries, 362  
   innominate artery, 350  
   intra-cranial aneurism, 356  
   intra- horacic aneurism, 347
- Priapism from calculus, 1031
- Primary, adhesion, healing by, 245  
   and secondary amputations, 689  
     after joint-excision, 614. *See*  
     Special Excisions
- bubo, 176  
 syphilis, 173, 175
- Probang for larynx, 847
- Probing the nasal duct, 741
- Prognosis, 4
- Projectiles, density of, 282  
   momentum of, 282  
   motion of, 283  
   penetrating power of, 283  
   shape of, 282  
   velocity of, 282
- Prolapsus (*Lat.* a falling forth) of anus,  
 1002  
   from calculus, 1031  
   causes of, 1003  
   cauterization in, 1005  
   diagnosis of, 1003  
     from piles, 997  
   excision of, 1005  
   ligature of, 1005  
   rectum, 993, 1002  
   reduction of, 1004  
   signs of, 1003  
   structural conditions of, 1002  
   treatment of, 1004  
     constitutional, 1004  
     local, 1004  
   of tongue, 803  
   uterus, 1169  
   vagina, 1169
- Prolapsus and procidentia, 1169

- Proliferous** (*proles*, a progeny; *fero*, I bear)  
 cysts, 85  
   cutaneous, 85  
   cystigerous, 85  
   dentigerous, 85  
   glandular, 85
- Prostate gland**, abscess of, 1085  
   peri-prostatic, 1086  
   atrophy of, 1093  
   calculus in, 1094  
   cancer of, 1093  
   cysts in, 1094  
   dilatation of, in lithotomy, 1041  
   disease of, producing irritable bladder,  
     1081  
   diseases of, 1085  
   enlargement of, 1086  
     from calculus, 1095  
     chronic, 1086  
     causes of, 1088  
     consequences, 1091  
     diagnosis of, 1090  
     difficulty in lithotomy from, 1048  
     influence on lithotripsy, 1066  
     pathology of, 1092  
     retention of urine from, 1092  
       treatment of, 1092  
   structural conditions of, 1086  
     alterations in prostatic  
       urethra and neck of blad-  
       der, 1087  
     symptoms of, 1088  
     terminations of, 1091  
     treatment of, 1092  
   hæmorrhage from, 1093  
   incision of, in lithotomy, 1040  
     danger of excessive,  
     inflammation of, 1085  
       causes of, 1085  
       retention of urine from, 1120  
       symptoms of, 1085  
       treatment of, 1085  
   tubercle of, 1094
- Prostate**, diseases of, 1058
- Prostatic calculus**, 1094  
   catheter, 1090
- Prostatitis** (*prostate*, gland; *itis*),  
 1085
- Prostatorrhœa** (*prostate*; *ῥέω*, I flow),  
 1100
- Prostration with excitement**, 235
- Protrusion of abdominal viscera**, 909
- Provisional callus**, 416
- Pruritus ani** (*Lat.* itching of the anus) 1018
- Psoas abscess**, 869  
   diagnosis of, 869  
   from femoral hernia, 964
- Psoriasis of tongue**, 804  
   syphilitic, 182
- Pterygium** (*πτερυγῆς*, a wing), 746  
   excision of, 746
- Ptoxis** (*πτῶσις*, a falling), congenital, 738  
   operation for, 738
- Pubic dislocation of thigh-bone**, 558  
   symphysis, dislocation of, 550
- Pudendum**, abscess of labium, 1167  
   chancere of, 176  
   closure of labia or vagina, 1168  
   condylomata on, 1166  
   cystic tumours of, 1167  
   diseases of, 1166  
   epithelial cancer of, 1167  
   hypertrophy of clitoris or labiæ,  
     1166  
   rodent ulcer of, 1167  
   vascular or erectile tumours of, 1168
- Pudendal hernia**, 975
- Pudic artery**, aneurism of, 363
- Pulpy gangrene**, 216
- Pulsating bronchocele**, 851  
   diagnosis from aneurism, 353  
   tumours, diagnosis from aneurism,  
     323  
     of bone, 505. *See* Osteo-Aneurism
- Pulsation of aneurism**, 322  
   of intra-thoracic aneurism, 347  
   recurrent, after operation for aneu-  
     rism, 336  
   at root of neck, 349
- Pulsatile tumour of bone**, 505
- Pulse in innominate aneurism**, 350
- Punctum lachrymale**, slitting the, 741
- Puncture of bladder**, 1121
- Puncture of bladder above pubes**, 1122  
   through rectum, 1121  
   symphysis pubis, 1122
- Punctured fracture of skull**, 716  
   wounds, 276  
     of arteries, 255  
     nerves, 318
- Punctures in inflammation**, 63, 75  
   for examination of effusion in, 77
- Pupil**, artificial, formation of, 754
- Purgatives in inflammation**, 67  
   piles caused by use of, 998
- Purpura**, 162
- Purulent deposits**, 208, 210  
   infection, 208. *See* Pyæmia  
   secretion, 49
- Pus**, 46  
   cancerous, 47  
   cells of, 46  
   characters of, 46  
     in pyæmic abscess, 210  
   chemical composition of, 47  
   formation of, 47  
     pathology of, 49  
   function of, 54  
   ichorous, 135  
   microscopic appearance of, 46  
   mucous, 47  
   relation of, to blood corpuscles, 47  
     chyle corpuscles, 47  
     exudation corpuscles, 47  
     granulation cells, 54  
     mucous corpuscles, 47  
   sanguineous, 47  
   serous, 47  
   within skull, 718, 725  
   treatment of, 726, 729

- Pus** (*continued*)—  
 specific, 47  
 strumous, 47  
 syphilitic, 47  
**Pustular eruptions**, syphilitic, 182  
**Putrescent animal matter**, wounds inoculated with, 208  
**Pyæmia** (πύον, pus; αἷμα, blood), 208  
 abscesses, secondary, in, 209  
   diagnosis of, 210  
   formation of, 215  
   situations of, 210  
   treatment of, 216  
   from animal or septic matter, 208  
 arthritis from, 574  
 a cause of death after operation, 19, 688  
 causes of, 215  
   operation of, 215  
 changes of blood in, 210  
 death from, modes of, 210  
 in injuries of head, 718  
 pathology of, 210  
 phenomena of, 209  
 post-mortem appearances in, 209  
 from purulent absorption, 210  
 purulent deposits in, 210  
 symptoms of, 209  
 treatment of, 216  
   preventive, 216  
   remedial, 216  
**Pyogenic** (πύον, pus; γεννάω, I produce) membrane, 52  
**Pyogenesis** (πύον, pus; γεννάω, I produce), 47
- QUADRILATERAL** section of prostate, 1057  
**Quilled suture**, 250
- RABID** animals, bites of, 223. *See* Hydrophobia  
**Rachitis**, or Rickets, 497  
**Radial artery**, aneurism of, 360  
   ligature of, 384  
**Radical cure of hernia**, 921. *See* Special Herniæ  
   of hydrocele, 1141  
   varicocele, 1148  
   varicose veins, 405  
**Radius**, dislocations of, 538  
   excision of, 678  
   fractures of, 461  
**Railway collisions**, concussion of spine in, 862  
   twists or wrenches of spine in, 863  
**Ranula**, 807  
   treatment of, 807  
**Rattlesnake**, bite of, 228  
**Reaction from shock**, 533  
**Rebreaking and resetting bones**, 433  
**Rectal fistulæ**, 1010  
**Rectangular-staff operation of lithotomy**, 1056
- Recto-vaginal** (*rectum*, the straight intestine; *vagina*) fistula, 1011  
**Recto-vesical** (*rectum*, the straight intestine; *vesica*, the bladder) fistula, 1010  
   operation of lithotomy, 1057  
**Rectum**, abscess of, 985  
   arrangement of veins of, 993  
   atony of, 1017  
   cancer of, 1009  
   fistulæ of, 1010  
   foreign bodies in, 1013  
   functional disorders of, 1017  
   irritability of, 1017  
   malformations of, 1014  
     deficiency of, 1015  
   by membranous obstruction, 1015  
   neuralgia of, 1018  
   opening of into other canals, 1010  
   polypi of, 1005  
     diagnosis from piles, 997  
     varieties of, 1005  
   prolapse of, 993, 1002  
   puncture of bladder through the, 1121  
   scirrhus of, 1009  
   stricture of, fibrous, 1007  
     treatment of, 1008  
   malignant, 1009  
     treatment of, 1010  
   ulcer of, 991  
   wound of, 1012  
     in lateral lithotomy, 1050  
     in median operation, with rectangular staff, 1056  
**Recurring fibroid tumour**, 96  
   of breast, 897  
   origin of, 97  
   recurrence after removal of, 97  
   treatment of, 97  
**Red particles of blood**, changes of, in inflammation, 26  
**Redness in inflammation**, 27  
   appearances of in mucous membranes, and in skin, 27  
   colour of, 27  
   a sign of, and its value, 27  
   from development of new vessels, 27  
**Reducible hernia**, 919. *See* Hernia  
   tumours of groin, 945  
**Reduction of dislocations**, 513  
   compound, 519  
   of fractures, 418  
     compound, 425  
     hernia, 920. *See* Hernia  
     strangulated hernia, 925  
   prolapse recti, 1004  
**Reef-knot**, 260  
**Regions**, injuries and diseases of, 713  
**Regnoli's operation on the tongue**, 805  
**Renal calculus**, 1030  
   symptoms of descent of, 1030  
   treatment of, 1030  
**Repair after joint-excision**, 613  
   in joints after destruction of cartilage, 584  
**Resection**. *See* Excision



- Resolution of inflammation, 41  
 Respiration, artificial, 835  
     after treatment, 836  
     methods of, 835  
 Results of surgical operations, 19  
 Retention of urine, 1120. *See* Urine  
 Retina, diseases of, 761  
 Retinitis, 761  
 Retraction of nipple in cancer, 900  
 Retractors in amputation, 682  
 Retroversion (*retro*, backwards; *verto*, I turn) of uterus, 1169  
 Rheumatic arthritis, chronic, 575  
     of hip, 592  
     synovitis, treatment of, 573  
 Rheumatism, blood origin of, 166  
     blood-pathology of, 166  
     diagnosis of, 165  
     from aneurism, 367  
     from circumscribed abscess of bone, 489  
     from hip-disease, 590  
     from osteo malacia, 499  
     from spinal concussion, 865  
     fever of, 165  
     gonorrhoeal, 573  
     symptoms of, 165  
     treatment of, 167  
         curative, 167  
         preventive, 167  
 Rhinoliths, 791  
 Rhinoplastic operations (*ῥιν*, the nose; *πλάσσω*, I form), 791  
 Rhinorrhœa, 784  
 Ribs, fractures of, 444  
     compound, 444  
 Rickets, 497  
     causes of, 497  
     diagnosis from osteomalacia, 499  
     of pelvic bones, complicating lithotomy, 1050  
     signs of, 497  
     structural condition of bone in, 497  
     termination of, 498  
     treatment of, 498  
 Risus sardonius, 236  
 Rodent ulcer, 1167  
 Roseola, syphilitic, 181  
 Rotatory displacement in fracture, 412  
     in lateral curvature of spine, 873  
 Rupture of abdominal viscera, 908  
     of aneurism, 325  
         axillary, 360  
         carotid, 354  
         in cranium, 357  
         in neck, at root of, 351  
         popliteal, 368  
         subclavian, 359  
     arteries, idiopathic, 324  
         traumatic, 145  
     bladder, 463  
     bowels, 908  
     diaphragm, 909  
     heart, 82  
     kidneys, 909  
     Rupture (*continued*)—  
         of liver, 909  
         lung, 882  
         muscle and tendon, 309  
         pericardium, 882  
         spleen, 909  
         stomach, 908  
 SAC of hernia, 914. *See* Hernia  
 Sacculated aneurism,  
     bladder, 1109. *See* Encysted  
         Calculus, 1048  
     kidneys, 1109  
 Sacro-iliac articulation, disease of, 592  
     abscess in, 593  
     causes of, 593  
     diagnosis of, 593  
     lameness in, 592  
     length of limb in, 592  
     pain in, 592  
     prognosis of, 594  
     shape of limb in, 593  
     signs of, 592  
     size of limb in, 593  
     swelling in, 592  
     termination of, 594  
     treatment of, 594  
     dislocation of, 550  
 Sacrum, fractures of, 465  
 Sacs in omentum, 915, 933  
 Salivary fistula, 801  
     treatment of, 801  
 Salter's swing-apparatus, 480  
 Sanguineous cysts, 85  
     in bone, 501  
     in thigh, 87  
     pus, 47  
 Sarcocœle (*σάρξ*, flesh; *κῆλη*, a tumour), 1151  
     chronic, 1151  
     diagnosis of, 1152  
     nodular scrofulous, 1152  
         syphilitic, 1151  
     scrofulous, 158, 1152  
         consequences of, 1152  
         treatment of, 1153  
     simple, 1151  
     syphilitic, 185, 1151  
         consequences of, 1151  
         treatment of, 1152  
     tuberculous, 1152  
 Sarsaparilla in secondary syphilis, 197  
 Saw, amputating, 680  
     application of, 707  
     Butcher's, 610  
     for excision of jaw, 825  
     Hey's, 730  
     for necrosis, 497  
         section of neck of femur, by W. Adams's operation, 640  
 Scab, healing under, 246  
 Scalds, 292  
     of glottis, mouth, and pharynx, 832

- Scalp, cephalhæmatoma of, 714  
 contusion of, 714  
 diseases of, 713  
 extravasation under, 714  
 injuries of, 713  
 nævus of, 731  
 wens of, 731  
 wounds of, 713
- Scalpels, 610  
 for lithotomy, 1038, 1041
- Scaphoid bone, dislocation of, 571  
 excision of, 649
- Scapula, caries of, 678  
 dislocation of, 532  
 excision of, 676-8  
 fractures of, 449  
 necrosis of, 676  
 tumours of, 677
- Scar. *See* Cicatrix
- Schneiderian membrane, thickening of, 785  
 diagnosis from polypus, 787
- Sciatic artery, aneurism of, 363  
 hernia, 976
- Sciatica, diagnosis from sacro-iliac disease, 593
- Scirrhus wart, 1134  
 diagnosis from chancrous induration, 1134  
 common wart, 1134
- Scirrhus (*σκιρρῶς*, a hard swelling), 106  
 characters of, 106  
 course of, 117  
 cyst formation in, 111  
 diagnosis of, 108  
 effects of, 115  
 number of formations in, 113  
 origin of, 114  
 secondary deposits from, 121  
 situation of, 113  
 structure of, 106  
 terminations of, 118  
 tumour of, 107  
 ulceration in, 118  
 ulcer of, 118  
 varieties of, 110
- Scirrhus of breast, 899. *See* Breast  
 nose, 783  
 parotid region, 854  
 penis, 1134  
 rectum, 1009  
 testicle, 1156  
 tongue, 804
- Scleritis, 749  
 chronic, 750  
 diagnosis of, 750  
 treatment of, 750
- Scorbutic ulcer, 39
- Scoop, ear, 773  
 lithotomy, 1042
- Scrofula (*scrofa*, a sow), 153  
 blood-origin of, 159  
 pathology of, 159  
 in absorbent glands, 154  
 in bones and joints, 156  
 causes of, 159
- Scrofula (*continued*)—  
 in cellular texture, 154  
 in internal ear, 157  
 laryngitis in, 158  
 in lip, upper, 157  
 inflammation modified by, 153  
 mammary tumour in, 158  
 in mucous membrane, 156  
 in nails, 156  
 in nose, 157  
 operations in, 161  
 ophthalmia in, 157  
 relation to tuberculosis, 153  
 in salivary glands, 157  
 in skin, 155  
 special forms of, 153  
 symptoms of, 153  
 in testicle, 158  
 in tongue, 157  
 in tonsils, 157  
 treatment of, 160  
 ulcer in, 153
- Scrofulous caries, 492  
 of joints, 579  
 spine, 867
- diathesis, 160  
 necrosis, 495  
 ostitis, 486  
 ozæna, 784  
 periostitis, 486  
 synovitis, 577  
 temperament, 159  
 testicle, 1152  
 tumours of breast, 158
- Scrofulous, or strumous ulcer, 140
- Scrotal abscess, 1124  
 fistula, 1125  
 hernia, 918, 938, 958
- Scrotum, anasarca of, 1136  
 calculi in, 1138  
 cancer of, 1138  
 cystic tumour of, 1138  
 disease of, 1136  
 elephantiasis of, 1136  
 results of excision of, 1137  
 treatment of, 1137
- erysipelas of, 1136  
 fatty tumour of, 1138  
 fibrous tumour of, 1137  
 hypertrophy of, 1136  
 inflammatory œdema of, 1136  
 œdema of in new-born infant s, 11  
 tumours of, 1137
- Scurvy, 162  
 blood-origin of, 163  
 pathology of, 163  
 symptoms of, 162  
 treatment of, 154  
 curative, 164  
 preventive, 164
- Searcher, lithotomy, 1042
- Sebaceous cysts, 87  
 of eyelids, 739  
 scalp, 731
- Secondary abscesses, 209

- Secondary amputation, 639  
   aneurism, 336  
   colloid, 121  
   deposits of cancer, causes of, 120  
   encephaloid, 121  
   scirrhus, 121  
   hæmorrhage, 685. *See* Hæmorrhage  
   syphilis, 180. *See* Syphilis  
 Section, subcutaneous, in false-joint, 438  
   of neck of femur, 640  
   nerve in neuralgia, 320  
   tendons, 595  
   in reduction of dislocations, 525  
   of fractures, 422  
   in varicocele, 1148  
   of varicose veins, 406  
 Sediments, or deposits, urinary, 1021  
 Semilunar bone, dislocation of, 548  
 Seminal cysts, 85  
   emissions, 1158  
   flux, 1158  
 Senile gangrene, 401. *See* Gangrene  
 Sensation, injuries of in spinal concussion, 865  
 Separation, line of, in gangrene, 148  
 Septum crurale, relation to femoral hernia, 960  
 Septum of nose, abscess of, 785  
   caries and necrosis of, 785  
   diagnosis from polypus, 787  
   fracture of, 441  
   tumours of, 791  
   ulcer of, 785  
 Sequestrum (*Lat.* a thing deposited), removal of, by natural separation, 493  
   by operation, 495  
 Sero-cystic tumour of breast, 895  
 Sero-pus, 47  
 Serous cysts, 85  
   membranes, effusions in inflammation of, 47, 49  
 Serpiginous inflammation, 200  
 Serrefine, 251  
 Serum, effusion of, 41  
 Seton, 64  
   in false joint, 439  
   in hydrocele, 1142  
 Sheaths of tendons, inflammation of, 316  
 Shock, 232  
   causes of, 232  
   predisposing, 233  
   a cause of mortality after operation, 19, 668  
   chloroform in, 235  
   in gunshot wounds, 284  
   of injury, 232  
   after operations, 19, 688  
   operation during, 235  
   prognosis of, 234  
   reaction from, 233  
   symptoms of, 232  
   terminations of, 233  
   treatment of, 234  
 Short-sight, 768  
 Shot, injuries by, 282  
 Shoulder-joint, amputation at, 696  
   results of, 697  
   disease of, 656  
   dislocations of, 532  
   excision of, 656  
   for injury, 671  
   fractures near, 450, 452  
   gunshot wounds of, 289  
 Sight affected by intra-cranial aneurism, 356  
   day, 769  
   long, 769  
   night, 769  
   short, 768  
   affected by spinal concussion, 864  
 Silicious calculus, 1027. *See* Calculus  
 Silvester's method of artificial respiration, 835  
 Simple chancre, 174  
   cysts, 84  
   dislocation, 503. *See* Dislocation  
   fracture, 411. *See* Fracture  
 Sinus, 53  
   frontal, diseases of, 794  
   in hip-disease, 589  
   in scrofulous joint-disease, 580  
   in spinal abscess, 870  
   treatment of, 77  
 Skin, and subjacent textures, injuries and diseases of, 243  
 Skin, cancer of, 112  
   recurrent in, 119  
   in cancer of breast, 900  
   che'loid disease of, 290  
   chilblains, 305  
   corns, 308  
   epithelial cancer of, 127  
   gonorrhœal eruptions of, 1099  
   horns, 308  
   mercurial eczema of, 196  
   morbid cicatrices of, 289  
   nævus of, 103  
   painful tubercle, under, 94  
   scrofula of, 155  
   syphilitic diseases of, 181  
   in infants, 188  
   tumours of, 309  
   ulcers of, 135  
   warts of, 308  
 Skull, contusion of, 714  
   extravasation within, 718, 721, 725  
   foreign bodies in. *See* Depressed fracture  
   fractures of, 715  
   base of, 719  
   brain substance discharged in, 720  
   causes of, 720  
   diagnosis of, 720  
   effects of, 720  
   hæmorrhage from ears in, 720  
   from nose or mouth, 720  
   into orbit, 720  
   serous fluid discharged in, 720



- Skull, fracture of base of, (*continued*)—  
 symptoms of, 720  
 terminations of, 721  
 treatment of, 721  
 vomiting of blood in, 720  
 by contre-coup, 721  
 of vault of, 715  
 causes of, 717  
 comminuted, 716  
 compound of, 716  
 consequences of, 718  
 depressed, 717  
   diagnosis of, 717  
   punctured, 716  
   symptoms of, 717  
   treatment of, 719  
   trephining in, 719, 730  
   varieties of, 716  
 effects of, 717  
 necrosis of, 505  
 simple, 715  
 suppuration within, 718, 725, 728  
 treatment of, 718  
 trephining the, 729. *See* Trephining
- Sliding tubes for dilating stricture, 1112
- Slough, 57  
 in contused wounds, 722  
 formation of, 59  
 in gunshot wounds, 284  
 separation of, 59  
 treatment of, 78
- Sloughing of aneurism, 327  
 after ligature, 337  
 of bubo, 177  
 of cancer, 118  
 chancre, 175. *See* Chancre  
 in erysipelas, 201  
 of hernial sac, 917, 934  
 after lithotomy, 1052  
 phagedæna, 216. *See* Hospital Gangrene  
 of stumps, 686  
 ulcer, 139
- Sloughy ulceration of gums, 809
- Snake-bites, 228  
 constitutional disorder from, 228  
 local condition in, 228  
 period of latency in, 229  
 treatment of, 229
- Snow's chloroform inhaler, 16
- Softening, 29  
 of bone, 491  
 of brain from intra-cranial aneurism, 357  
   ligature of carotid artery, 354  
 inflammatory, 29  
 of spinal cord, 862
- Soft cancer, 106  
 chancre, 191  
 polypus, 786
- Solution of stone in bladder, 1071
- Sounding for stone, 1031  
 dangers from, 1033  
 errors in, 1033
- Sounding for stone (*continued*)—  
 knowledge gained by, 1032
- Sounds for lithotomy, 1032  
 lithotriety, 1059  
 uterine 1170
- Spasm of bladder, 1032, in lithotomy, 1049  
 in lithotriety, 1064  
 of muscles after fracture, 417, 423
- Spasmodic contraction of sphincter ani, 1018  
 spermatorrhæa, 1159  
 stricture of œsophagus, 843  
   diagnosis of, 843  
   treatment of, 843  
 urethra, 1117  
   causes of, 1117  
   symptoms of, 1117  
   treatment of, 1118
- Special arteries, aneurisms of, 347  
 degenerations, 133  
 dislocations, 527  
 fractures, 441  
 hernia, 938  
 joints, excision of, 615  
 tumours, 83
- Special pathology and surgery, 243
- Specific inflammations, 81  
 poisons causing gangrene, 144
- Speculum ani, 992  
 vaginæ, 1172, 1011
- Spermatic cord, diseases of, 1138  
 division of in castration, 1157  
 hæmatocele of, 1146  
   diagnosis from hernia, 1146  
 hydrocele of, 1144  
   diagnosis from inguinal hernia, 945  
   diffused, 1144  
   relations of to hernia, 940  
   varicocele of, 1146
- Spermatorrhæa (*σπέρμα*, seed; *ρίω*, I flow), 1158  
 causes of, 1158  
 passive, 1158  
 spasmodic, 1159  
 treatment of, 1160
- Spermatozoa in fluid of encysted hydrocele, 1144
- Sphacelus (*σφάκελος*, gangrene), 143  
 of intestine in hernia, 917  
   treatment of, 932  
 of omentum in hernia, 917  
   treatment of, 932  
 of piles, 996  
   treatment of, 999  
   in prolapsus recti, 1003
- Sphincter ani, spasmodic constriction of, 1018
- Spina bifida (*Lat.* cleft spine), 881  
 course of, 881  
 structural conditions in, 881  
 symptoms of, 881  
 treatment of, 881
- Spinal cord, concussion of, 861  
 from direct violence, 863

**Spinal cord, concussion of (*continued*)—**

- causes of death in, 866
- paralysis from, 863
- primary symptoms of, 863
- recovery from, 863
- secondary symptoms of, 863
- softening of cord in, 862
- from indirect violence, 863
- meningitis from, 862
- myelitis from, 862
- pathological conditions in, 862
- period of appearance of symptoms, 863
- post-mortem examination of, after railway collision, 862
- progress of development of symptoms after, 864
- secondary effects of, 863
- softening in, 862
  - after railway collision, 862
- symptoms of, 863
  - cerebral, 864
  - in limbs, 864
  - in nutrition, 865
  - pulse in, 865
  - sexual power in, 865
  - spinal, 864
  - temperature in, 865
- diagnosis of, 865
- prognosis of, 865
- recovery after, 866
- symptoms of, 863
- terminations of, 865
  - period of death in, 866
- treatment of, 866
- compression of, 859, 867
- division of, 857
- effect of slight blows on, 863
- fracture, implicating, 859
- hæmorrhage into, 859
- inflammation of, 862
- laceration of, 859
- softening of, 862
- wounds of, 857
  - causes of, 857
  - in cervical region, 857
  - in dorsal region, 857
  - in lumbar region, 857
  - symptoms of, 857

**Spine, angular curvature of, 867**

- caries of, 867
  - abscess in, 868
    - varieties of, 870
  - causes of, 868
  - changes in vertebrae by, 867
  - diagnosis of, 868
    - from sacro-iliac disease, 593
  - prognosis of, 871
  - psaos abscess in, 869
  - structural conditions in, 867
  - symptoms of, 868
  - terminations of, 868
  - treatment of, 871
    - prone couch, 871
    - spinal support, 872

**Spine (*continued*)—**

- diseases of, 856
  - dislocations of, 529, 859
  - fractures of, 859
    - causes of, 860
    - course of, 860
    - dislocation with, 859
    - injury of cord in, 859
    - symptoms of, 859
    - terminations of, 860
      - period of death in, 860
    - treatment of, 860
    - trephining in, 861
  - injuries of, 857
  - lateral curvature of, 873
    - causes of, 875
    - consequences of, 876
    - curve-respiratory, 875
      - weight-bearing, 875
    - diagnosis from hip-disease, 590
    - mechanical contrivances for, 876
    - reduction couch of Buhning, 878
    - signs of, 874
    - structural condition of, 873
    - treatment of, 876
  - posterior curvatures of, 880
    - cyphosis, 880
    - lordosis, 880
    - treatment of, 881
  - sprains of, 857
- Splay foot, 604
- Spleen, laceration of, 909
- state of in pyæmia, 210
- Splinters in gunshot wounds, 279
- Splints, Dupuytren's, 483
- Gadt's, for excision of knee-joint, 618
  - Heath's, for excision of elbow-joint, 652
  - Lister's, for excision of wrist, 665
  - Liston's long, 472
  - McIntyre's, 479
  - pistol-shaped, 462
- Sponge-probang, introduction of into larynx, 847
- Spongy ulceration of gums, 162
- Sprains or strains, 309
- treatment of, 309
  - of joints, 506
  - spine, 857
- Squamæ, syphilitic, 182
- Squint, operations for, 771
- after-treatment, 772
- Stafford's lancet catheter, 1115
- Staff for lithotomy, 1038
- rectangular, 1056
  - straight, 1044
- Staphyloma (*σταφυλος*, a bunch of grapes) of cornea, 749
- of sclerotic, 753
- Staphyloraphy (*σταφυλος*, a bunch of grapes, the tonsils; *ράπτω*, I sew), 814
- Fergusson's operation, 815
  - Pollock's operation, 816
  - Warren's operation, 816

- Starched bandage after joint-excisions, 612  
     of knee, 620  
     in fractures, 423  
     application to fractured leg, 423  
         thigh, 474
- Steatoma (*στέαρ*, tallow), 91
- Sterility in the male, 161
- Sternum, fractures of, 446  
     compound, 446
- Sthenic (*σθένος*, strength) inflammation, 79
- Stimulants in low inflammations, 72
- Stings, 243
- Stomach, persistent sickness of, after chloroform, 17  
     treatment of, 17  
     rupture of, 908
- Stomach pump, use of, 844
- Stomatitis (*στόμα*, a mouth; *itis*, denoting inflammation), gangrenous. *See* Cancerum Oris, 802  
     syphilitic, in children, 1881
- Stone in the bladder, 1031. *See* Calculus
- Strabismus (*στραβός*, squinting), operation for, 771  
     Graefe's, 772  
     old, 771  
     sub-conjunctival, 772
- Strains, 309
- Strangulated hernia, 923. *See* Hernia
- Strangulation, 834  
     gangrene from, 146  
     of hernial protrusion, 916  
     internal, 979  
     of piles, 996
- Strapping the testis, 1151
- Stricture in hernia, 923. *See* Hernia  
     of œsophagus, 842. *See* Œsophagus  
     intestinal, chronic, 977  
         congenital, 977  
         diagnosis of, 979  
     nasal duct, 741  
     rectum, 1006. *See* Rectum  
     urethra, 1103. *See* Urethra
- Struma: *See* Scrofula
- Strumous node, 486  
     ulcer, 140
- Stumps, by amputation, circular, 683  
     flap, 683. *See* also Particular Amputations  
         rectangular flap, 684  
     conical, 686  
     from contused and lacerated wounds, 271  
         gunshot wound, 271  
     dressing of, 684  
         re-dressing of, 685  
     healthy, 687  
     in hospital gangrene, 217  
     morbid conditions of, 685  
     necrosis of, 686  
     neuralgia of, 687  
     painful and spasmodic, 687  
     secondary hæmorrhage from, 685  
         phenomena of, 686
- Stumps (*continued*)—  
     secondary hæmorrhage from, treatment of, 686  
     sloughing of, 686  
     structural changes in, 687
- Subaponeurotic cephalhæmatoma, 714
- Subastragaloid amputation, 701
- Subcranial suppuration, 751
- Subclavian artery, aneurism of, 358  
     ligature of, 377  
     vein. *See* Vein
- Subclavicular dislocation, 533
- Subcoracoid dislocation, 532
- Subcutaneous injection in hysterical jerkings of limb after joint-excision, 612  
     in neuralgia, 320  
     section of tendons, 595  
     in false-joint, 438  
     of neck of femur, 640  
     nerve in neuralgia, 320  
     in reduction of dislocations, 525  
         of fractures, 422  
         varicocele, 1148  
         varicose veins, 406
- Subglenoid dislocation, 532
- Subluxation (*sub*, under; *luxo*, I dislocate) of lower jaw, 527  
     of knee, 564
- Submammary abscess, 892
- Subpericranial cephalhæmatoma, 714
- Subspinous dislocation, 533
- Superficial femoral artery, aneurism of, 365  
     ligature of, 392
- Supernumerary breasts, 907  
     nipples, 907
- Suppuration (*suppuro*, I turn into pus), 52  
     diffused, 52  
     hectic fever in, 55  
     pathology of, 47  
     symptoms of, 52  
         in different textures, 52  
     treatment of, 75
- Suppuration of aneurismal sac, 327  
     after ligature, 337  
     in axillary aneurism, after ligature of subclavian, 360  
     in carotid aneurism, after ligature of artery, 355  
     in femoral aneurism, after ligature of external iliac, 364  
     in innominate aneurism, after distal ligature of carotid, 352  
     in popliteal aneurism, after ligature of superficial femoral, 369
- of antrum, 818  
     bone, 487  
         circumscribed abscess of, 489  
         diffuse periostitis, 488  
         osteomyelitis, 487  
         periosteal abscess, 489  
     breast, 892  
     in burns, 295  
     cerebral, 729  
     in erysipelas, 201  
     hip-joint disease, 589



**Suppuration (continued)—**

- intra-cerebral, 729
- intra-cranial, 729
- intra-meningeal, 728
- in joints, 574
- of piles, 995
- in prostate, 1085
- in sacro-iliac disease, 593
- subcranial, 729
- in whitlow, 306
- wounds, contused and lacerated, 275
  - gun-shot, 284
  - punctured, 277

**Suppurative arteritis, 399**

- granulation, healing by, 246
- phlebitis, 407

**Super-mammary abscess, 892****Supra-pubic lithotomy, 1057**

- in females, 1071

**Surgery, as a science and scientific art, 2**

- comparison of Continental and English Schools of, 5

**Surgeon, responsibilities of a, in relation to performance of operations, 11****Surgical operations, pathology in the design and performance of, 5****Sutures, 249**

- in amputation, 685
- button, 251
- figure-of-8, 250
- Glover's stitch, 250
- in hare-lip, 796
- interrupted, 250
- in joint-excision, 611
- materials for, 249
- needle for, 250
- quilled, 250
- with split shot, 1011
- twisted, 250
- uninterrupted, 250
- in wounded intestine, 911

**Swelling in inflammation, 28**

- causes of, 28
- consistence of, 29
- diagnostic value of, 29
- shape of in different textures, 29
- size of in different textures, 28

**Symblepharon (σύν, together; βλέφαρον, an eyelid), operation for, 738****Syme's amputation of foot, 700**

- operation for removal of tongue, 805
- for stricture, 1115

**Sympathetic inflammation of eyes, 771****Symphysis pubis, dislocations of, 550****Syncope from chloroform, 17****Synechia, σύν, together; ἔχω, I hold), 753**

- treatment of, 753

**Synovial membrane, diseases of, 572**

- inflammation of, 572

**Synovitis (synovial, membrane; itis, denoting inflammation), 572**

- abscess in, 575

- treatment of, 575

- causes of, 573

**Synovitis (continued)—**

- chronic, 575
- rheumatic, 575
- scrofulous, 577
- signs of, 573
- structural conditions of, 572
- terminations of, 574
- treatment of, 574

**Syphilis (etym. uncertain; probably σῦς, a hog; and φιλέω, I love), 173**

- causative relation of local to constitutional, 191
- modus operandi of infection, 191
- communicated by vaccination, 189
- constitutional manifestations of, 180
- diagnosis of, 189
- incubation, period of, 180
- indolent bubo in, 177
- indurated or Hunterian chancre in, 174, 191. *See* Chancre
- infantile, 187

- communication of, 188
- symptoms of, 188

- teeth affected by, 189

**\* infection of ovum in, 188****inoculation, as the test of, 178, 191****local, 173****primary, 173, 175**

- H. Lee's four varieties of, 175

- treatment of, 197

**secondary, 180**

- blood-origin of, 190

**pathology of, 190**

- characters of, 181
- local manifestations of, 181
- mercury in, 194
- treatment of, 193

**syphilization, 198****tertiary, 187****transmissibility of, 187****treatment of, 192**

- of constitutional, 193

- curative, 194

- preventive, 193

**local, 192**

- curative, 193

- preventive, 192

**unity or duality of syphilitic virus, 191****vaccino-syphilitic inoculation, 189****Syphilitic alopecia, 187****cachexia, 187****caries, 186****condylomata, 184****disease of absorbent glands, 186****of bones, 186****hair and nails, 187****internal organs, 187****larynx, 184****lips, 184****mouth, 184**

- in infants, 188

**mucous membranes, 183**

- in infants, 188

**nose, 184**

- in infants, 188

- Syphilitic disease of palate, 184  
 pharynx, 181  
 skin, 181  
     in infants, 188  
 testis, 185  
 throat, 183  
 tongue, 184  
 ecthyma, 183  
 exanthemata, 181  
 excrescences, 308  
 impetigo, 183  
 iritis, 185  
 lepra, 182  
 lichen, 181  
 mucous tubercle, 184  
 necrosis, 186  
 nodes, 186  
 onychia, 187, 307  
 otitis, 187, 485  
 periostitis, 486  
 psoriasis, 182  
 psyraceous pustules, 182  
 pustules, 182  
 roseola, 181  
 sarcocele, 1151  
 squamæ, 182  
 synovitis, 573  
 teeth, 189  
 tubercles, 182  
     of tongue, 804  
         diagnosis from cancer,  
 ulcer, 141, 183. *See* Chancre, and  
     Bubo of Tonsils, 183  
 vegetations, 3081  
 verrucæ, 308, 1166  
 vesicles, 182  
 warts, 308, 1133  
 Syphilo-dermata (*Syphilis*; δέρμα, the  
 skin), 181  
 Syringe, laryngeal, 848  
     for lithotomy, 1037  
     for lithotripsy, 1059

# TAGLIACOTIAN operation, 792

- Talipes (*talus*, an ankle; *pes*, a foot),  
 600  
     Bigg's orthopede for equino-varus, 606  
     calcaneo-valgus, 606  
     calcaneus, 605  
         treatment of, 605  
         Bigg's apparatus for, 605  
     equinus, 600  
         causes of, 601  
         signs of, 600  
         structural condition of, 600  
         treatment of, 601  
         Scarpa's shoe, 602  
     flat or splay-foot, 604  
     valgus, 604  
         causes of, 604  
         treatment of, 604  
     varus, 602  
         causes of, 602  
         structural condition of, 600

- Talipes varus, treatment of, 601  
     Aveling's talivert, 603  
     varieties of, 605  
 Tanjore pill, 229  
 Tapping the abdomen, 983  
     abscesses, 77  
     the chest, 888  
     head, 732  
     hydrocele, 1141  
     ovarian tumours, 1176  
     the pericardium, 889  
 Tarsus, amputation through, 699  
     dislocations of, 570  
     excisions of bones of, 646  
     fractures of, 483  
 Taxis (τάσσω, I put in order), 920  
 Teale's amputation, 684  
 Tear-passages, operations on, 741  
 Teeth, alveolar abscess, 808  
     caries of, 811  
     diseases of, 811  
     dislocation of, 811  
     eruption of milk-teeth, 811  
     fracture of, 811  
     hæmorrhage after extraction of, 813  
     inflammation of pulp-cavity of, 812  
     injuries of, 811  
     irregularities of permanent teeth, 811  
     mal-eruption of wisdom teeth, 811  
     misplacements of, 811  
     necrosis of, 811  
     neuralgic toothache, 813  
     polypus of tooth-pulp, 812  
     tooth stopping and extraction, 813  
 Temperament, scrofulous, 160  
 Temperature of body, how affected in in-  
 flammation, 28  
     in pyæmia, 209  
     in spinal concussion, 865  
 Tendo-Achillis, division of, in club-foot, 601  
     in fracture of leg, 422  
     treatment of rupture of, 311  
 Tendons, diseases of sheaths of, 316  
     displacement of, 312  
     division of, 595  
     hamstring, contraction of, 600  
     imperfect and non-union of, 312  
         treatment of, 312  
     inflammation of sheaths of, 316  
     injuries of, 309  
     repair of, 310  
     rupture of, 309  
         causes of, 310  
         symptoms of, 309  
         terminations of, 310  
         treatment of, 311  
         sprains of, 309  
 Teno-synovitis (τένον, a tendon; *synovial*,  
 membrane; *itis*, denoting inflammation),  
 316  
 Tenotomy (τένον, a tendon; τέμνω, I cut),  
 595  
 Tertiary syphilis, 187  
 Testis, abscess of, 1153  
     atrophy of, 1158

**Testis (continued)—**

- cancer of, 1155
    - castration in, 1157
  - cartilaginous tumour of, 1155
  - chronic enlargement of, or sarcocele, 1151
  - cystic tumour of, 1153
  - diseases of, 1138
  - fibrous tumours of, 1155
  - functional disorders of, 1158
    - impotency, 1161
    - neuralgia, 1162
    - spermatorrhœa, 1158
  - fungus of, 1156
  - hernia of, 1153
  - inflammation of, 1149
    - causes of, 1149
    - gonorrhœal, 1149
    - in inguinal canal, 945
      - diagnosis from hernia, 945
    - symptoms of, 1149
    - terminations of, 1150
    - treatment of, 1150
  - mal-position of, 1162
  - mis-descent of, 1163
  - orchitis and epididymitis, 1149
  - relation to inguinal hernia, 940
  - scrofulous, 1152
    - consequences of, 1152
    - treatment of, 1153
    - varieties of, 1152
  - strapping the, 1151
  - syphilitic, 1151
    - consequences of, 1151
    - treatment of, 1152
    - varieties of, 1151
  - tumours of, 1153
    - castration for, 1154
    - diagnosis from hernia, 945
  - undescended, abnormal situations of, 943
    - in congenital hernia, 945
    - diagnosis from inguinal hernia, 1163
    - diseases of, 1163
    - inversion of, 1163
- Tetanus (τετανος, I stretch), 236**
- after amputations, 688
  - a cause of death in operations, 19, 688
  - causes of, 240
  - condition of wound in, 240
  - diagnosis of, 237
  - forms of, 236
  - idiopathic, 240
  - after joint-excision, 614
  - after ligature of external iliac artery, 364
    - superficial femoral, 368
  - pathology of, 238
  - period of probation after injury, 240
  - prognosis of, 241
  - symptoms of, 236
  - terminations of, 241
  - traumatic, 240
  - treatment of, 241

**Tetanus (continued)—**

- trismus in, 236
- varieties of, 237
- Textures, injuries and diseases of, 243
- Thigh, amputation of, 706
  - arteries of. *See* Artery, femoral
  - gunshot wounds of, 288
- Thigh-bone. *See* Femur
- Thompson's lithotrite, 1059
- stricture-expander, 1114
- tracheotome, 850
- Thorax, injuries of parietes of, and organs, 882
- Throat, syphilitic disease of, 183, 196
  - wounds of, 827
- Thumb, amputation of, 692
  - dislocations of, 549
- Thyroid gland, diseases of, 850. *See* Bronchocele
  - diagnosis from carotid aneurism, 353
- Tibia, dislocation of, 562
  - in contraction of knee, 599, 615
  - excision of, 680
  - fractures of, 478
- Tibial artery. *See* Artery, tibial
- Toe-nail, horn of, 308
  - in-growing of, 307
- Toes, amputations of, 697
  - dislocations of, 572
  - excision of, 649
  - fractures of, 483
- Tongue, abscess of, 804
  - cancer of, 804
    - treatment of, 805
  - cysts in, 807
  - diseases of, 804
  - encephaloid of, 805
  - epithelial cancer of, 805
  - fatty tumour in, or under, 807
  - fissures or cracks of, 184
  - foreign bodies in, 803
  - glazed and warty, 803
  - inflammation of, 804
  - nævus of, 807
  - prolapsus of, 803
  - psoriasis of, 804
  - ranula in, 807
    - treatment of, 807
- removal of, 805
  - by écraseur, 806
    - excision, 805
      - complete, 805
      - partial, 805
    - ligature, 806
  - Arnott's and Cloquet's method, 806
  - Hilton's method, 806
  - methods of, compared, 895
  - Moore's method, 806
  - Regnoli's operation, 805
  - Syme's operation, 805
- scirrhus in, 804
- syphilitic disease of, 184
  - tubercle of, 804
- tie, 803



- Tongue (*continued*)—  
tumours of, 804  
ulceration of, 804  
wounds of, 802
- Tonics in inflammation, 73
- Tonsil-guillotine, 840
- Tonsillitis, 838
- Tonsils, diseases of, 838  
chronic enlargement of, 839  
treatment of, 839  
excision of, 839  
inflammation of, 838  
causes of, 839  
terminations, 839  
treatment of, 839
- Tophi (*Lat.* sand or gravel-stone), in ear, 774
- Torsion of arteries, 264  
comparison of with ligature and acupressure, 265  
modes of, 265  
occlusion by, 264
- Torticollis (*tortus*, twisted, from, *torqueo*, I twist; *collum*, the neck), 594
- Touch, impairment of in spinal concussion, 864
- Tourniquet in amputation, 681  
in gunshot wounds, 285  
hæmorrhage, 259
- Trachea, diseases of, 845  
foreign bodies in, 830  
injuries of, 827  
operations on. *See* Laryngotomy and Tracheotomy  
pressure on by aortic aneurism, 348  
carotid aneurism, 353  
dislocated clavicle, 530  
innominate aneurism, 350  
tumours in neck, 855  
wounds of, 828
- Trachea-forceps dilator, Garin's, 850  
hooks, 849  
Thompson's tracheotome, 850  
tubes, 850  
Fuller's bivalve, 850  
Liston's, 849
- Tracheal trocar and canula, 850
- Tracheotomy (*τραχέια*, the trachea; *τέμνω*, I cut), 848  
in children, 848  
compared with laryngotomy, 848  
difficulties in, 848  
in introducing tube, 849  
opening trachea, 850  
exposing trachea in, 849  
for foreign bodies, 831, 850  
hæmorrhage in, 849
- Transmissibility of syphilis, 187
- Transverse fractures, 412
- Traumatic (*τραύμα*, a wound) aneurism, 324. *See* Aneurism and Arteries  
arachnitis, 728  
cataract, 757
- Traumatic causes of gangrene, 143  
delirium, 234  
emphysema, 886  
encephalitis, 727  
causes of, 728  
prognosis of, 728  
symptoms of, 727  
treatment of, 728
- gangrene, 143. *See* Gangrene  
hæmatocele, 1145  
hydrocele, 1140  
inflammation of brain and membranes, 727  
meningitis, 727  
necrosis, 494  
peritonitis, 912  
phlebitis, 408  
pleurisy, 882  
pneumonia, 882  
pneumothorax, 886  
synovitis, 573  
tetanus, 240. *See* Tetanus
- Treatment, relative importance of diagnosis, etiology, and prognosis, to, 4
- Trephining bone, 490, 729  
in circumscribed abscess of, 490  
the skull, 729  
for extravasated blood, 726  
in fracture, 726  
for pus in skull, 726, 729  
results of, 730
- Trichiasis (*θριζ*, hair), treatment of, 737
- Trismus (*τριζω*, I grind the teeth), 236
- Trochanter, great, caries of, 635
- Trochanters, amputation through, 711
- Trocar, for tapping chest, 888
- Trusses, 920  
application of, 920
- Tuberculosis, relation to scrofula, 153
- Tubercle in bone, 485  
circumscribed, and diffused, 485  
softening of, 485  
mucous, 184  
painful subcutaneous, 94  
of prostate, 1094  
syphilitic, 182  
of mucous membranes, 184  
skin, 182  
testis, 1151  
tongue, 804  
in testicle, 1152
- Tubercular eruptions, syphilitic, 182
- Tubular aneurism, 321
- Tumours, 81  
adipose, 90. *See* Fatty Tumour  
aneurism by anastomosis, 105  
atheromatous, 85  
cancerous, 105. *See* Cancer  
cyst-formation in, 111  
situation of, 112  
varieties of, 109  
cartilaginous, 97. *See* Enchondroma,  
varieties of, 99

**Tumours (continued)—**

- classification of, 83
- colloid, 106. *See* Cancer and Colloid varieties of, 111
- cystic, 86. *See* Cystic Tumour cysts, 84
  - diagnosis of, 85
  - proliferous, 85
  - simple, 85
  - varieties of, 86
- diagnosis from abscess, 86
  - aneurism, 323
- encephaloid, 106. *See* Cancer and Encephaloid varieties of, 109
- enchondromatous, 97. *See* Enchondroma varieties of, 99
- encysted, 86. *See* Cystic Tumour
- epithelial cancer, 126
- erectile, 160
- excision of, 83
- fatty, 90. *See* Fatty Tumour varieties of, 91
- fibro-calcareous, 96
- fibro-cellular, 92
- fibro-cystic, 96.
- fibro-nucleated, 96
- fibroid, recurrent, 96
- fibro-plastic, 99. *See* Myeloid
- fibrous, 95
  - varieties of, 96
- general characters of, 81
  - structural, 81
  - vital, 82
- glandular, 105
- infiltrating growths, 105
- innocent, 82
- of integumental structures, 85, 1175. *See* Cutaneous Proliferous Cysts
- localized, or non-infiltrating, 83
- malignant, 82. *See* Cancer
  - general signs of, 82
- melanotic cancer, 110
- myeloid, 99. *See* Myeloid Tumour
- nævus, 103
- neuroma, 95
- non-pulsating, diagnosis from aneurism, 323
- osseous, 105
- painful subcutaneous, 94
- pulsating, diagnosis from aneurism, 323
- scirrhus, varieties of, 110. *See* Cancer and Schirrus
- sebaceous, 85, 731
- special, 83
- treatment, general indications of, 83
- vascular. *See* Erectile, 100
- warty, 303
- wens, 85, 731
- of alveoli, 809
- antrum. *See* Tumours of Jaws

**Tumours (continued)—**

- in axilla, diagnosis from aneurism, 359
- of bladder, 1074
  - diagnosis from enlarged prostate, 1090
- bone, 500
- brain, 732
- breast, 895
- bursæ, 314
- cheeks, 801
- conjunctiva, 747
- cranium, 731
- dura mater, 731
- external ear, 774
- eyeball, 770
- eyelids, 739
- groin, 945
  - diagnosis from aneurism, 364
  - from hernia, 945
  - iliac and psoas abscess, 870
- gums, 809
- hæmorrhoidal, 994, 995. *See* Piles
- head, 731
- intra-thoracic, aneurismal, 348
- of jaw, lower, 821
  - upper, 820
- labia, 1166
- lachrymal gland, 740
- lacteal, 906
- of larynx, 847
  - lips, 799
  - malar bone, 823
  - mouth, 801. *See* also Tongue
  - muscles, 313
  - naso-pharyngeal, 790
  - neck, 855
    - diagnosis from aneurism, 353
    - dysphagia from, 855
    - dyspnœa from, 855
  - nerves, 94, 320. *See* Neuroma
  - nose, 783
    - septum of, 791
  - omentum, 933
  - orbit, 770
  - ovaries, 1174
  - parotid gland, 853
    - region, 854
  - penis, 1133-5
  - pharynx, 842
    - dysphagia from, 842
  - in popliteal space, diagnosis from aneurism, 337
  - of prostate, 1093
    - rectum, polypoid, 1005
  - of scalp, 731
  - scrotum, 1137. *See* Scrotum
  - skin, cancer, 112, 619
    - corns, 308
    - horns of, 308
    - nævus of, 103
    - warts of, 303
  - spermatic cord, 1144, 1146
  - testis, 1153

Tumours (*continued*)—

- diagnosis of, 1154, 1156
- from hernia, 945
- thyroid body, 850. *See* Bronchocele
- tongue, 804
- of urethra, 1118
- uterus, 1170
- vagina, 1169
- Tunica vaginalis, hæmatocele of, 1145
- diagnosis from cancer of testicle, 1145
- hernia, 945
- hernia in, 942
- encysted, 944
- hydrocele of, 1139
- diagnosis of, from cystic sarcocele, 1140
- from hæmatocele, 1140
- inguinal hernia, 1140
- varieties of, 1140
- Tunnelling the prostate, 1093
- Twisted suture, 250
- Twists of spine, 863
- Typical cases of joint-excision. *See* Excisional Surgery of Special Joints

## ULCER, 134

- cancerous, 141
- treatment of, 141
- cicatrization of, 135, 274
- diagnosis of, from wound, 243
- diagnostic characters of, 135
- granulation of, 135, 272
- healthy, 135
- treatment of, 136
- hæmorrhagic, 139
- treatment of, 139
- indolent, 137
- treatment of, 137
- inflamed, 136
- treatment of, 136
- irritable, 136
- treatment of, 136
- local contagious, 173, 217. *See* Chancre, and Hospital Gangrene
- lupoid, 141
- treatment of, 141
- on mucous membranes, 183, 156
- cedematous, 137
- treatment of, 137
- phagedænic, 139
- treatment of, 139
- scorbutic, 139
- treatment of, 140
- scrofulous, or strumous, 140
- treatment of, 140
- sloughing, 139
- syphilitic, 141
- of mucous membranes, 183, 184, 187, 188
- treatment of. *See* Species of, 135
- varicose, 137
- situation of, 137

Ulcer (*continued*)—

- treatment of, 137
- varieties of, 135
- venereal. *See* Chancre
- weak. *See* Edematous
- of anus, 991
- of cheeks, corroding, 801
- cicatrix, 291
- cornea, 748
- duodenum, after burns, 295
- guns, 809
- larynx, 845
- lips, 184, 156, 799
- mouth, corroding or phagedænic, 802
- nose, 187, 785
- rectum, 991
- skin, cancerous, 144, 118
- epithelial, 129
- syphilitic, 183, 804
- tongue, 156, 804
- syphilitic, 184, 804
- tonsils, syphilitic, 804, 183
- Ulceration, 134
- causes of, 147
- extension of, by ichorous discharge, 135
- ichor, product of, 135
- pathology of, 134
- in relation to degeneration, 134
- to mortification, 134
- a result of inflammation, 57
- textural liability to, 148
- treatment of. *See* Species of Ulcers
- of bone, 490. *See* Caries
- cancer, 118
- cartilage, articular, 582
- Ulna, dislocations of, 540
- excision of, 678
- fractures of, 457
- Ulnar artery. *See* Artery, Ulnar
- Umbilical hernia, 970. *See* Hernia
- Unilateral dislocation of lower jaw, 527
- Unilocular cyst of ovary, 1174
- Union by adhesive inflammation, 245
- first intention, 245
- of fractured bone, 415
- delayed, 436
- by granulation, 246
- secondary, 273
- immediate, 245
- of incised wounds, 244
- mediate, 245
- by modelling process, 247
- of nerves, 245, 318
- by primary adhesion, 245
- scabbing, 246
- of tendons, 310
- Unity, or duality, of syphilitic virus, 191
- Unreduced dislocation, 522
- Ununited fracture, 433
- causes of, 435
- effects of, 435
- structural conditions of, 433
- terminations of, 436
- treatment of, 437



Urate of ammonia calculus, 1024  
 of soda or lime, 1024  
 Ureter, calculus in, 1030  
 descent of, 1030  
 treatment of, 1030  
 rupture of, 1020  
 Urethra, abscess of, 1099  
 absence of, 1135  
 bulb of, wounded, 1051  
 calculus in, 1119  
 broken, impacted in, 1119  
 in lithotripsy, 1064  
 chancre of, 176  
 in children, 1046  
 deficiency of, 1135  
 dilatation of, in removing calculus in  
 female, 1069  
 behind stricture, 1104, 1109  
 in treatment of stricture, 1109,  
 1112  
 diseases of, 1095  
 effect of enlarged prostate on, 1087  
 examination of in stricture, 1105  
 external incision of, 1115  
 false passages in, 1111  
 female, dilatation of, 1069  
 fistula of, 1125. *See* Urinary Fistula  
 plastic operations for, 1126  
 foreign bodies in, 1119  
 hæmorrhage from, 1129  
 after catheterism, 1112  
 in gonorrhœa, 1099  
 inflammation of, 1095  
 causes of, 1096  
 specific, 1096. *See* Gonorrhœa  
 symptoms of, 1095  
 treatment of, 1098  
 in treatment of stricture, 1112  
 internal incision of, 1114  
 irritation of, 1097  
 laceration of, 1129  
 missing the, in lithotomy, 1051  
 muscular structure of, 1117  
 plastic operations on, 1126  
 polypoid tumours of, 1118  
 rectum opening into, 1014  
 stricture of, 1103  
 annular, 1103  
 bridle, 1103  
 congestive, 1118  
 organic, 1103  
 causes of, 1107  
 consequences of, 1108  
 number of, 1104  
 pathological conditions re-  
 sulting from, 1109  
 situations of, 1103  
 structural conditions of,  
 1103  
 symptoms of, 1104  
 terminations of, 1108  
 treatment of, 1109  
 by caustics, 1114  
 division of, 1114

Urethra, stricture, organic (*continued*)—  
 external urethro-  
 tomy, 1115  
 internal urethro-  
 tomy, 1114  
 gradual dilatation,  
 1109  
 immediate and for-  
 cible, 1112  
 varieties of, 1105  
 catheterism in, 1105  
 accidents attending, 1111  
 anæsthetics in, 1110  
 difficulties in, 1111  
 dilator, Holt's in, 1113  
 distending instrument, Thomp-  
 sons, 1114  
 congenital, 1108  
 contractile or recurring, 1105  
 detection of, 1107  
 diagnosis of from enlarged pros-  
 tate, 1090  
 dilatation of, 1109, 1112  
 continuous, 1110  
 instruments for, 1110, 1112,  
 1113, 1114  
 external urethrotomy, 1115  
 extravasation of urine in, 1108  
 impermeable, operation for, 1116  
 indurated annular, 1103  
 inflammatory, 1118  
 causes of, 1118  
 symptoms of, 1118  
 treatment of, 1118  
 internal urethrotomy, 1114  
 results of, 1115  
 irritable, 1105  
 linear, 1103  
 perineal section for, 1115  
 permeable, 1115  
 results of, 1116  
 retention of urine from, 1120.  
*See* Urine, retention of  
 rupture or splitting of, 1113  
 results of, 1113  
 of bladder from, 1108  
 urethra from, 1108  
 simple, 1105  
 situation of, 1103  
 sliding tubes in, 1112  
 spasmodic, 1117  
 causes of, 1117  
 symptoms of, 1117  
 treatment of, 1118  
 suppression of urine from, 1108  
 symptoms of, 1104  
 tortuous, 1103  
 treatment of, 1109  
 urinary abscess from, 1124  
 fistula from, 1125  
 tumours in, 1118  
 treatment of, 1118  
 wound of, 1129  
 Urethral calculus, 1119

Urethral forceps, 1119  
 lithotomy, 1070  
 Urethritis (*urethra*; *itis*, denoting inflammation), 1095. *See* Urethra, inflammation of  
 Urethroplasty (*urethra*; *πλάσσω*, I form or fashion), operations, 1126  
 Urethrotome (*urethra*; *τέμνω*, I cut), 1114  
 Urethrotomy (*urethra*; *τέμνω*, I cut), in impermeable stricture, 1116  
   internal, 1114  
   perineal, 1115  
   for permeable stricture, 1115  
   for urinary fistulæ, 1126  
 Urethro-vaginal fistula, 1127  
 Uric acid calculus, 1024  
   oxide, 1024. *See* Lithic Acid  
 Urinary abscess, 1124  
   calculus, 1021. *See* Calculus  
   fistulæ, 1125  
   organs, effect of calculus on, 1035  
     of enlarged prostate on, 1092  
     stricture on, 1109  
   organs, foreign bodies in, 1020  
     states of, influencing propriety of operation, 9  
   vaginal fistulæ, 1127  
 Urine, albuminous, in relation to lithotomy, 1053  
   to lithotripsy, 1066  
   blood in, 1066, 1076, 1099  
   deposits in, 1021. *See* Calculi  
   extravasation of, 1123  
     from rupture of bladder, 1124  
       symptoms of, 1124  
       treatment of, 1124  
     from rupture of urethra, 1123  
       symptoms of, 1123  
       treatment of, 1123  
   flow of, impeded by calculus, in bladder, 1031  
     in urethra, 1119  
   functional morbid conditions of bladder, 1079  
   by stricture of urethra, 1104, 1117, 1118  
   by tumours of bladder, 1034, 1074  
     urethritis, 1097  
   by enlarged prostate, 1088  
   irritable bladder from morbid states of, 1081  
   in mollities ossium, 499  
   retention of, 1120  
     from atony of bladder, 108  
     in cystitis, 1072  
     from enlarged prostate, 1084, 1089, 1092  
       catheterism in, 1092  
       puncture above pubes, 1093  
       through rectum, 1093  
       tunnelling prostate in, 1093  
       treatment of, 1092

Urine, retention of (*continued*)—  
   from gonorrhœa. *See* Spasmodic Stricture  
   from paralysis of bladder, 1082  
     perineal abscess, 1120  
     prostatitis, 1085  
     stricture, inflammatory, 1118, 1120  
       organic, 1104  
       forcible catheterism in, 1121  
   puncture above pubes in, 1122  
     through rectum, 1121  
     through symphysis pubis, 1122  
     urethrotomy in, 1121  
   spasmodic, 1117, 1120  
   treatment of, 1120  
   urethral calculus, 1119, 1120  
   tumours, 1118, 1120  
 Uro-stealith calculus from, 1025  
 Use of stomach-pump, 844  
 Uterine fistula, 1127  
 Uterus, absence of, 1174  
   anteversion of, 1169  
   cancer of, 1173  
     diagnosis of, 1173  
     signs of, 1173  
     treatment of, 1173  
   cauliflower excrescence of, 1173  
   displacements of, 1169  
     causes of, 1170  
     treatment of, 1170  
   fibrous tumours of, 1170  
   flexion of, 1169  
   gravid, in umbilical hernia, 971  
   latero-version of, 1169  
   polypi of, 1170, 1172  
   prolapsed, 1169  
   retroversion of, 1169  
   tumours of, 1170  
   ulceration of, cancerous, 1173  
 Uvula, elongation of, 840  
   cause of, 840  
   treatment of, 841

**V**ACCINATION, syphilis transmitted by, 189  
 Vaccino-syphilitic inoculation, 189  
 Vagina, discharge from, 1098  
   in children, 1096  
   closure of, 1168  
   diseases of, 1164, 1166  
   epithelial cancer of, 1167  
   erectile tumour of, 1167  
   fistulous openings into, 1011, 1127  
   foreign bodies in, 1166  
   imperforate hymen, 1168  
   prolapsed of, 1169  
   rectal fistulæ into, 1011

Vagina (*continued*)—

- rectal fistulæ from congenital mal-formation of anus, 1014
- rodent ulcer of, 1167
- tumours of, 1169
- urinary vaginal fistulæ, 1127
- uterine fistulæ of, 1127
- wounds of, 1164

## Vaginal hernia, 975

- lithotomy, 1070
- speculum, 1172

## Valsalva's treatment of aneurism, 329

Varicocele (*varix* : κήλη, a tumour), 1146

- causes of, 1147
- diagnosis of, 1147
- from hernia, 945
- radical cure of, 1148
- signs of, 1146
- treatment of, 1147

## Varicose aneurism, 343

- causes of, 345
- consequences of, 345
- signs of, 344
- structural condition of, 343
- treatment of, 346
- operation for, 346
- preventive, 345
- ulcer, 137
- veins, 403

## Varix, aneurismal, 343

- of arm, 361
  - causes of, 345
  - consequences of, 345
  - in groin, 365
  - leg, 370
  - neck, 355, 359
  - signs of, 344
  - structural condition of, 343
  - in thigh, 367
  - treatment of, 345
  - of veins, appearance of, 403
  - causes of, 404
  - cauterization of, 406
  - compression of veins in, 405
  - diagnostic characters of, 403
  - injection of, 406
  - locality of, 404
  - radical cure of, 405
  - of saphena vein, diagnosis from hernia, 964
  - structural conditions of, 403
  - subcutaneous section in, 406
  - terminations of, 404
  - treatment of, 405
  - twisted suture in, 405
  - venous hæmorrhage from, 406
- Vascularization of granulations, 273
- of lymph, 43
- Vascular tumour, 100
- Veins, air in, 267. *See* Air in Veins
- gangrene from obstruction of, 146
  - hæmorrhage from, 266
  - during lithotomy, 1051
  - inflammation of, 407. *See* Phlebitis

Veins (*continued*)—

- injuries of, 403
  - obstruction of, in phlebitis, 407
  - pressure of aneurism on, 325
  - in abdominal, 326
  - axillary, 359
  - femoral, 364, 366
  - intra-thoracic, 348
  - popliteal, 367
  - aneurisms at root of neck, 350
  - subclavian, 358
  - stones in, 408
  - varicose, 343. *See* Varix
  - wounds of, 266
- Vein or Veins, axillary, laceration of, in reduction of old dislocation of humerus, 537
- femoral, wound of in ligature of artery, 393
  - varix of, 365, 367
  - jugular, aneurismal varix of, 355
  - of neck and arm, enlarged in innominate aneurism, 350
  - pulmonary, pressure of aortic aneurism on, 348
  - of rectum, arrangement of predisposing to piles, 993
  - saphena, varix of, diagnosis from femoral hernia, 964
  - subclavian, aneurismal varix of, 359
- Velum palati, tumours of, 841
- Venous vascular tumour, 100
- Vent de boulet, 282
- Ventilation, importance of, in relation to erysipelas, 206
- to hospital gangrene, 221
  - operations, 10
  - pyæmia, 216
  - scrofula, 160
- Ventral hernia, 973
- Vermale's amputation, 703
- Verrucæ, 308, 1166. *See* Warts
- Vertebræ. *See* Spine
- changes in, in caries, 867, 869
  - dislocation of, 529, 859
  - fracture of, 859
  - in lateral curvature, 873
- Vesical. *See* Bladder
- Vesicles, syphilitic, 182
- Vesico-vaginal fistula, 1127
- Villous cancer, 113
- tumour of bladder, 1075
- Virus, hydrophobic, 223
- syphilitic, 173, 191
- Vesiculæ seminales, diseases of, 1163
- diagnosis of, 1163
  - treatment of, 1163
- Viscera, abdominal, injuries of, 908
- Volvulus, diagnosis of, 979
- Vomiting of blood in fractured base of skull, 720
- of feculent matter in intestinal obstruction, 979



Vomiting of feculent matter in strangulated hernia, 923

Von Graefe's operation of iridectomy, 768

for strabismus, 772

Vulva, diseases of, 1164

**W**AKLEY'S stricture dilating tubes, 1112

Warmth in inflammation, 62

Warts, 308

of epithelial cancer, 126

gonorrhoeal, 1133, 1166

on anus, 1012

labia, 1012, 1166

lips, 800

penis, 1133

scirrhus. *See* Cancer

on scrotum, 1133

syphilitic, 1012, 1133, 1166

venereal, 308

Wasps, stings of, 243

Water-dressing, 251

Wax, accumulating of, in ear, 775

Weak ankles,

ulcer. *See* Oedematous

Weiss and Thompson's lithotrite, 1059

Wens, 87, 731

White corpuscles, in inflammation, 26

increase of, 26

White swelling, 572

Whitlow, 305

involving sheath of tendons, 306

necrosis from, 307

treatment of, 306

Wind-contusions, 282

Windpipe, operations on, 848. *See* Laryngotomy and Tracheotomy

Wisdom-teeth, mal-eruption of, 811

Wood's operations for hernia, 921

femoral hernia, 965

inguinal hernia, 951

umbilical hernia, 972

Worm-eaten caries, 491

Wounds, 243

arterio-venous, 343. *See* Aneurismal

Varix

contused, 270

dissection, 213

dressing of, 249

after dressing, 254

antiseptic, 251

erysipelas caused by, 205

gunshot, 278. *See* Gunshot Wounds

incised, 243

lacerated, 270

poisoned, 223, 243

punctured, 276

union of, 245. *See* Union

Wounds of abdomen, 908

involving viscera, 908

air-passages, 828

ankle-joint, 507

Wounds (*continued*)—

gunshot, 288, 289

arteries, 255. *See* Arteries

complicating fracture, 431

in operation for hernia, 933

femoral, 969

inguinal, 958

lithotomy, 1050

of bladder, 1019

in fracture of pelvis, 464

in lithotomy, 1051

of brain and membranes, 726

bulb of urethra, in lithotomy, 1051

cerebral nerves, 726

cheeks, 801

fistulous openings from, 801

of chest, 882

involving organs, 882

diaphragm, 909

dura mater, 721. *See* Hernia

Cerebri

ears, 773

elbow-joint, 507

gunshot, 289. *See* also Excision

of eye, 733

eyelids, 733

face. *See* Cheeks

forehead. *See* Scalp

genital organs. *See* Penis, and Vulva

heart, 882

by fractured sternum, 446

hip joint, 507

gunshot, 288. *See* also Excision

intestines, 908

in operation for hernia, 933

treatment of, 933

joints, 506

by fracture, 431

gunshot injury, 288

synovitis from, 507

kidneys, 909

knee-joint, 507

gunshot, 289. *See* also Excision

larynx, 828

lips, 795

liver, 909

lungs, 882

by fractured ribs, 444

sternum, 446

mouth. *See* Cheeks

nerves, 318

union of, 245

oesophagus, 828

orbit, 733

palate, 817

penis, 1129

pericardium, 882

perineum, 1164

pharynx, 828

rectum in lithotomy, 1050

**Wounds** (*continued*)—

scalp, 713

treatment of, 713

shoulder-joint, 507. *See also* **Excision**

gunshot, 289

spinal cord, 857

spleen, 909

tetanus from, 240

throat, 827

tongue, 802

trachea, 828

urethra, 1129

vagina, 1164

veins, 266

vulva, 1164

wrist-joint, 507

gunshot, 288. *See also* **Excision****Wrenches** of spine, 857

in railway collision, 863

**Wrist**, amputation at, 693

dislocations of, 546

injuries allied to, 547

**Wrist** (*continued*)—

excision of, 661

for injury, 675

fractures near the, 547

gunshot wound of, 288

wounds of, 507

**Wry-neck**, 594

causes of, 595

treatment of, by apparatus, 596

by operation, 595

**Wutzer's** operation for hernia, 921, 951**XANTHIC** oxide calculus, 1024. *See*  
**Calculus****ZINC**, chloride of, in cancer, 123

in gonorrhœa, 1101

lupus, 141, 802

sulphate of, in gonorrhœa, 1101

**Zygoma**, disarticulation of, 442

fractures of, 442





# A GUIDE

TO THE

## EXAMINATIONS AT THE ROYAL COLLEGE OF SURGEONS OF ENGLAND,

FOR THE

### DIPLOMAS OF MEMBER AND FELLOW.\*

---

#### EXAMINATIONS FOR THE DIPLOMA OF MEMBER.

No one disputes the national importance of the Royal College of Surgeons, as the central home of biological science in this country—a science which represents the structure and functions of organized beings in health and disease, and the laws relating thereto. The possession of an absolutely unrivalled Museum of Anatomy—human, comparative, physiological, and pathological, though less complete—has long since rendered it simply impossible for any other institution to overtake the College in its vast material resources for *teaching* the science of life; and systematic expositions of these resources by Owen, Quekett, Huxley, and Flower, have, for a long period of years, attracted the profession in this and from foreign countries, with men of science in general, as students of Hunter's grand conception. Periodic orations have commemorated this epoch in the history of natural science. At the same time, the successive advancements and aspects of modern Surgery have been exhibited in yearly short courses of original lectures by some of the most distinguished Surgeons, past and present. But now, in the midst of reform and reorganization, relative to our medical corporate bodies, it seems desirable, and cannot be uninteresting, to inquire into what the College, as an *examining* board, has done meanwhile, and is doing, to sustain and extend the educational character of the profession, and to protect the just rights of the public in regard to the qualifications of men who are licensed to practise Surgery.

For this purpose I lately requested permission, which was readily granted by the President, to visit the College during the two examinations for the diploma of Member—the primary examination on Anatomy and Physiology, and the second or pass-examination on Surgical Anatomy and the Principles and Practice of Surgery. My visit had reference exclusively to the more important or *practical* part of these examinations. With the nature of the previous *written* examinations the profession is already familiar, the questions submitted to the candidates being duly published in *The Lancet* and other medical journals. But in order to present a

\* Enlarged from original communications to *The Lancet*, 1870, by the Author.

full and complete record of the examination for the diploma of Member, the written questions submitted to candidates in each of the two examinations on the occasions referred to are here introduced.

### PRIMARY EXAMINATION.

AT THE END OF SECOND WINTER SESSION.

ANATOMICAL AND PHYSIOLOGICAL EXAMINATIONS; 1870. April 23rd, from 1 to 4 o'clock P.M.—Candidates *must* answer four out of six questions. Answers to *less* than six questions will not be received before half-past 3 o'clock.

1. Describe the situation, attachments, and structure of the urinary bladder. Mention the portions of the bladder which are not covered by peritoneum, and the structures with which those portions are contiguous.
2. Describe the iris; its position, attachments, and structure. Mention its blood-vessels and nerves, and state the function it exercises in vision.
3. The thumb. Describe the position of the thumb, its bones, its articulations, its capability of motion, and the muscles by which its movements are effected.
4. Mention the muscles which enlarge the capacity of the chest during ordinary inspiration. Explain the mode by which ordinary expiration is effected.
5. Describe the changes which take place in the circulation of the blood after the birth of the child.
6. Describe the position and attachments (origin and insertion) of the biceps flexor cubiti, the brachialis anticus, the supinator radii, longus and brevis, the pronator radii teres, and the pronator quadratus. Mention the precise action of each muscle, and the nerve by which each is supplied.

The practical examinations on Anatomy and Surgery, which are most conclusive as the test of professional qualification, have not hitherto been made known. These examinations, which were instituted at the College in November, 1858, have been gradually developed during the last twelve years; and a recent report of the Court of Examiners, adopted by the Council in January of the present year, leaves no doubt of their general design. It is to test the student's practical knowledge of Anatomy and Surgery as the result of personal instruction.

PRACTICAL EXAMINATION ON ANATOMY; April 26th.—In the room, or theatre converted into a room, where the examination was held, several tables were arranged, on which were distributed a series of recent dissections and anatomical preparations of dissection, under flat glass receptacles, showing the regional and visceral anatomy of the body. The latter department of anatomy was supplemented by ordinary museum preparations arranged around the room. Textural anatomy, and the minute structure of organs, were provided for by four microscopes, and a useful series of microscopic preparations. At each table two examiners were engaged with a student or candidate for diploma. The general features of this anatomical examination may be here noted. Its essentially *objective* character was at once apparent. Accordingly, the *questions* asked were principally in the form of "What's this?" the examiner pointing at the same time to the object of his query. It will be evident that by this mode of examination a wide range of matter can be gone over in a limited time, as well as thus eliciting the student's knowledge of anatomical objects and facts.

Occasionally only, the student was asked to *describe* an object before

him; for that would imply the power of describing, and a facility of descriptive language, neither of which might be readily at command under the trying circumstances of an examination.

An enumeration of the following series of dissections and preparations will suffice to indicate the principal objects by which the student's practical knowledge of anatomy was tested.

*Regional Anatomy.*—Triangles of the neck, showing principally the relation and distribution of the blood-vessels; parotid region and side of the cheek, showing the course and opening of Stenson's duct; occipital region, showing the deep muscles, recti and obliqui; anatomy of the axilla; bend of the elbow; palm of the hand; Scarpa's triangle, showing the relation and distribution of the femoral vessels and anterior crural nerve; popliteal region, showing its boundaries, and the relation and course of the popliteal vessels and nerves; sole of the foot.—*Ligaments*: Temporo-maxillary articulation, ligaments, and inter-articular cartilage (a section view). Articulations and ligaments of the first two cervical vertebræ, one with the other, and as connected with the occipital bone; articulations and ligaments of the clavicle; shoulder-joint; elbow-joint; ligaments of the wrist and hand; hip-joint; knee-joint, showing the relative position of the crucial ligaments; head of the tibia, with the semilunar cartilages, showing their relative shape and size, as determining whether they formed part of the right or left knee-joint; ligaments of the ankle-joint, and of the foot.—*Bones*: Separate, and articulated in the skeleton. It will be in the recollection of those members of the College who underwent the examination some years since, that osteology then formed the only test of the student's objective knowledge of anatomy.

*Visceral Anatomy.*—Dissections and preparations of the brain. Lungs and heart, with their vessels in relative position, as seen when the anterior wall of the thorax is removed. Heart: section view, showing the course of the blood through its cavities. Stomach and liver: longitudinal section of the former organ when distended, showing its curvatures and fundus, orifices (cardiac and pyloric), and commencement of the duodenum; longitudinal section of the gall-bladder. Liver: showing its ligaments, lobes, and fissures; portal vein, hepatic duct, and hepatic artery, with their relative position at the transverse fissure. Intestinal canal; longitudinal section of the jejunum, presenting its valvulæ conniventes. Kidney, injected: longitudinal section, showing the relative position of the renal vessels and ureter at the hilus; also, the relative appearance and thickness of the pyramidal and cortical portions. Bladder, and urethra with penis, opened anteriorly; showing openings of the ureters, neck of the bladder, prostatic sinus, veru-montanum and sinus pocularis, with the openings of the common ejaculatory ducts; remainder of urethra, and trabecular structure of corpora cavernosa. Perineum, its ischio-rectal fossæ, and their boundaries, &c.

*Developmental Anatomy.*—Ossification of the bones; fœtal circulation, &c.

*Histology.*—As already stated, a series of specimens under the microscope were occasionally referred to, in order to test the student's objective knowledge of histology. For example, under one of the microscopes I observed a section of a tooth showing the dentine. Having regard to the great importance of textural anatomy, and of the minute structure of organs in relation to pathology, this portion of the practical examination on anatomy might be advantageously extended.



## SECOND OR PASS EXAMINATION.

AT THE END OF FOURTH YEAR.

EXAMINATION ON SURGICAL ANATOMY, AND THE PRINCIPLES AND PRACTICE OF SURGERY; April 29th, from 1 to 4 o'clock, P.M.—Candidates *must* answer at least four out of six questions. Answers to *less* than six questions will not be received before half-past 3 o'clock.

1. Describe the usual form of cancer affecting the testicle. Mention other structures which become affected during the progress of the disease. State the treatment which may be employed, and the probable result. 2. Mention the circumstances attending a compound dislocation at the ankle-joint which would induce you to amputate. 3. Describe the relative position of the subclavian artery in the third part of its course; and the different steps of the operation by which the vessel may be exposed. 4. Mention the kind of accident which might produce fracture of the base of the skull; and describe the symptoms which indicate such an injury. State the treatment to be adopted, and the probable or possible result. 5. Describe all the symptoms which indicate a fracture of the clavicle in the middle of the bone. State the position of the broken ends of the bone, and the cause of the deformity produced. Describe the treatment. 6. Myeloid tumour. Describe the local appearance and the symptoms of this tumour. Mention its microscopic character. State the treatment, and the probable result.

PRACTICAL EXAMINATION IN SURGERY, AND USE OF SURGICAL INSTRUMENTS AND APPARATUS; May 3rd.—On entering the room I saw four tables, on each of which lay a man stripped for the purpose of surgical examination. In the centre another table presented an assortment of surgical instruments, and ranged round the room in compartments, were bandages, splints, trusses, and other surgical apparatus indicated by placards—*e.g.*, made bandages, splints for arm, thigh, &c. The nude recumbent *figures*, for such they were, being perfectly motionless and passive, were well-formed and well-developed men; but they presented very different degrees of muscular development and contour, selected apparently for different objects of surgical examination. Thus, one man was of spare muscular development, but in his body the various bony prominences in the upper and lower extremities, stood out conspicuously. He was an excellent subject for *topographical* anatomy, as one of the examiners aptly designated it. Another man, of ample muscular form, was more suitable for amputation and the application of splints. A well-knit negro, whose picked-out muscles seemed to invite the ligature of arteries, supplied the subject requisite for this purpose. Red chalk was provided, so that the student should mark the course of the arteries, or of other subjacent parts, and the relative position of internal organs.

The prevailing character of this examination on Surgery, like that on Anatomy, was eminently practical, and designed to elicit the student's personal knowledge. He was asked to *point out* this, or to *do that*; occasionally only to give his reasons for something he had stated. While one examiner puts the student through his exercises, another makes notes of the questions, with certain remarks, on another paper, of "*good*," "*moderate*," or "*bad*." This last record is made, we believe, but rarely

and very reluctantly, for a second or third repetition of such failure might be fatal to the hopes of the student. At the expiration of ten minutes, announced by a bell-stroke, the student leaves the table where he has been engaged, taking with him the question-paper of his examination to another table, where the examiner is enabled to see what questions have been asked, in order to avoid any repetition. After another ten minutes the student passes on to a third; and lastly, to a fourth table. According to the sum total of marks in his favour, the candidate passes; or if adverse, he has "failed to acquit himself," &c., as the official notification subsequently announces.

The following questions illustrate the nature of this practical pass-examination on Surgery:—

*Lower Extremity.*—In synovitis of the knee-joint, point out the situations where the swelling presents. What structures restrain or prevent the appearance of swelling in certain parts of the joint? Put your finger on the insertion of the ligamentum patellæ, and name the prominence of bone. Mark, with chalk, on the skin, the course of the anterior tibial nerve, from its commencement to the ankle-joint. Under what muscle does the external popliteal nerve pass, below the head of the fibula? Point out the most common situation of fracture of the tibia. Point out the situations of fracture in the fibula and internal malleolus; constituting Pott's fracture. Twist the foot in the direction it then assumes; and why is it so turned? Lay hold of the foot, and mark the line of incision as for Chopart's amputation. Between what bones of the tarsus do you disarticulate? Do the same as for Hey's amputation. Lay hold of the second toe, and feel for the joint in amputation at the metatarso-phalangeal articulation. Mark the line of incision. Mark the course of the superficial femoral artery. Where would you compress the common femoral with your finger, and compress the artery? Apply a tourniquet. For flap-amputation of the thigh, in its middle third, direct how the leg should be held. Take this spatula and show where you would enter the knife, how transfix the limb, and where bring out the point of the knife. Indicate the lines of the flaps. Prepare the bone for the saw. Apply the saw. What main artery will require ligature, and where would you find that vessel? For ligature of posterior tibial artery, laterally, under the gastrocnemius, mark the line of incision; what muscle will be divided, and where will the artery be found? Apply lateral splints to the leg, and bandage from the foot. Put your finger on the internal abdominal ring; also into the external abdominal ring. What point of bone can be felt in the latter ring? Describe the course of oblique inguinal hernia. Show how to reduce the hernia. Select a proper truss; apply it. Make the requisite measurements with a tape, so that an instrument-maker in London may forward to you in the country a proper fitting truss. Put your finger on the saphenous opening in the thigh. What bounds it externally? Show how to reduce a femoral hernia, indicating the directions in which compression should be made, successively. Apply a spica bandage, also a double spica bandage.

*Upper Extremity.*—Compress the brachial artery with your fingers. Mark, with chalk, the course of the artery from the armpit to the bend of the elbow. Name the superficial veins in the arm, pointing them out severally. Apply a bandage, as for bleeding at the bend of the elbow. Place the arm in the direction it assumes from dislocation of the humerus into the axilla, or forwards, or backwards. What is the position of the

arm in fracture of the clavicle? Point out the acromion. Reduce a dislocation of the forearm backwards, placing your knee in position for counter-extension.

*Neck.*—Place the head as for tracheotomy. Mark the incision. Where should the trachea be opened? What vessels are in the way or proximate? Put your finger on the seventh cervical vertebra, and how do you know it?

*Thorax.*—Point out the situation of puncture for paracentesis thoracis. Mark, with chalk, the arch of the aorta; also the outline of the heart, and the apex where it strikes the wall of the chest. Mark the incisions for amputation of the breast.

*Abdomen.*—Point out the situation of puncture for tapping the abdomen. Why is that spot selected? Mark the lineæ semilunares. Mark the course of the abdominal aorta, and its termination. Also of the external iliac arteries. What is the relative position of the iliac veins? Where would you puncture the bladder above the pubes? Where, per rectum?

*Instruments.*—Select the instrument for puncturing the bladder per rectum. The instruments for lithotomy. Apply a trephine to the skull, placing the centre-pin in position. When should the latter be withdrawn? Apply a ligature to an artery, represented by the end of a bougie. Plug the nares, anterior and posterior, in the skull. Name various instruments on the table, and describe their uses.

CLINICAL EXAMINATION.\*—This examination consists in the diagnosis of, and statement of the treatment appropriate for, injury or disease, as exhibited by patients, in the average course of surgical practice. It forms part of the Practical Examination in Surgery, and the use of Surgical Instruments and Apparatus. The cases were such as may be seen mostly in the out-patients' room of any general hospital, and would be almost certainly met with during the period of Dressership required by the regulations of the College. Thus, among the cases brought forward in the first two Clinicals, were: an unreduced dislocation of the elbow-joint, of some duration; bony ankylosis of the hip-joint, consequent on arthritis, in a middle-aged man; a suppurating inguinal bubo; a synovial cyst in the popliteal space; an indolent ulcer of the leg, with the marks above of recent subcutaneous ligature in three or four parts of the long saphena vein. Candidates were requested themselves to examine, and state verbally what they found in these cases. For example, the hip-joint case presented, some shortening and eversion of the leg, and immobility of the hip-joint, so that in raising the limb on the pelvis, the latter moved with it and showed a characteristic fold in the abdominal wall, above the groin. This condition was also attended with some obliquity of the pelvis, and lateral curvature of the spine in the lumbar region, towards the sound side. The man's general health was good, or certainly not reduced as by recent and acute disease of the joint. After such examination, the diagnosis was asked, and the treatment—by the mechanical support of a high-heeled shoe. The other cases were gone through in like manner.

In the other part of this practical examination—that relating to external or topographical Anatomy, and Surgical Appliances—the course of examination was as heretofore. It comprised such questions as the following. Compress the subclavian artery with your thumb, in the third part

\* Instituted at the College, April 18th, 1871.



of its course. Point out where you would tap the chest, which margin of the intercostal space you would avoid, and why? Select and apply a truss for right inguinal hernia. Make the requisite measurements for such a truss. What splints would be used for a broken leg—fracture of both bones. Apply M-Intyre's splint. Apply side splints. Apply Dupuytren's splint for fractured fibula. These questions included the bandaging of the limb to secure the splints. Amputation of the breast: Place the arm in position, mark with red chalk the incisions, show how you would raise the breast, and to what depth, and how to remove any diseased axillary glands. The treatment of hæmorrhage in the operation, and secondary. Wooden-knives—in the shape of large scalpels and amputating knives—were used for the various representations of surgical operations, in the ligature of arteries, excisions, and amputations.

One feature in these practical examinations seems specially worthy of notice; it is the freedom from any embarrassment or difficulty to the candidate—assuming him to be well-prepared. This agreeable circumstance is partly due to the *objective* character of the examination, whereby readiness of language and much descriptive power are not at all essential to success; and the composure of the student is aided by the calmness and considerate bearing of the examiners. In one case, a candidate who laboured under great impediment of speech, but who evidently possessed the requisite knowledge, was facilitated by answering in writing; just a word or two on a piece of paper with a pencil, being quite sufficient for the questions—what's this, and what's that?

**PATHOLOGY AND SURGERY.**—This concluding subject of the practical pass-examination is held in the Council-room and large library adjoining. It is oral or *viva voce*; and each candidate is subjected to examination at two tables for a period of ten minutes at each table, making twenty minutes' examination instead of half an hour, as, until quite recently, has been the period. Examples: What is this? an angular curvature of the spine. Point out the caries. What are its consequences? In hip-joint disease, recognise the alterations which the head of the femur and acetabulum have undergone. Specimens of tumours or morbid growths, &c. Pathology being so directly supplemental to Practical Surgery, this part of the College examination might be most advantageously extended. But the College Museum, having no regular source of supply for the enlargement of its pathological department, should be aided by contributions from the hospitals, where duplicate specimens of value for the purpose of testing the student's knowledge are constantly accumulating.

**EXAMINATION ON THE PRINCIPLES AND PRACTICE OF MEDICINE.**—Candidates presenting themselves for the final examination for the membership or fellowship will be examined in Medicine, unless claiming exemption under the published regulations of the College. But a candidate who has passed an examination in Medicine for the membership, will not be required to pass any further examination in Medicine for the fellowship.

These regulations cannot be too widely known, for they concern most candidates for the diploma of Member, and many candidates for that of Fellow. The examination is written.

The following questions may be taken as illustrating the nature of this examination.

April 30th; from 1.30 to 3 P.M.—1. Give a short account of scarlet fever, and its varieties; your treatment of particular cases of the disease, and the method you would adopt to prevent its propagation. 2. Enume-

rate some of the commoner forms of the cutaneous diseases of the scalp, and their treatment. 3. Mention the principal Pharmacopœial purgative agents; and give the composition and doses of each.

*Oral or vivâ voce Examination in Medicine.*—This examination is held immediately at the termination of the *vivâ voce* in Pathology and Surgery; the candidates who have undergone the *written* examination in Medicine enter the adjoining room, or small library, and are subjected to questions by the examiners in Medicine. Each candidate is submitted to this additional test for ten minutes, and a second ten minutes when the first period has not proved satisfactory.

*Results of the preceding examinations for the diploma of Member.*—Primary examination, 1870, April 26th, 27th, and 28th: Number of candidates 103; 11 of whom had been up once previously, and 5 of the 11 twice before; the present occasion being their third trial. 43 of the whole number referred to their anatomical studies for three months. All these were candidates for the first time.—Second or Pass-examination, May 3rd and 4th: Number of candidates, 40; only 1 having been up on a previous occasion. 9 were referred for six months. The one previously referred, passed.—Medicine: Number of candidates, 24; 10 of whom were referred for a period of not less than three months.

In conclusion, the following general remarks will, I trust, not be unacceptable. As regards the *written* examination, the general characteristics of a "good" paper may be gathered from some of the most satisfactory, and which I have had the opportunity of carefully perusing. Each element of any question was answered successively, and nothing foreign to the question introduced. Conciseness and brevity are not only good qualities in a paper, but they enable the well-informed student to answer all the six questions, and with due allotment of space to each; instead perhaps of his being compelled to restrict his answers to the modicum requirement of only four questions, and possibly with an inadequate consideration of even these. Disregard of conciseness might lead the student unwittingly to be beaten by time; and the mere length of a paper is no measure of its sufficiency.

Having watched the course of *practical* examination in Anatomy and Surgery, it seemed to my judgment that students failed to acquit themselves satisfactorily mostly in topographical or external anatomy, and in the use and application of surgical apparatus. The former deficiency would appear referable to neglect on the part of the students to handle and observe for themselves the configuration of the body in the living, or even in the dead subject. Most dissectors' manuals give directions for observing, and a descriptive examination of, the various prominences and depressions to be seen and felt on the surface of the body, *before* commencing the dissection of the part in hand. But the student, in his eagerness to get the skin off and begin dissection, overlooks this very important preliminary knowledge of anatomy, and its relation to that beneath the surface. It should, however, always be remembered that the Surgeon, in practice, approaches the body from its exterior, and that the topography of the surface guides to the interior. The "crammed" student soon betrays his ignorance, by looking up to the ceiling for recollection when asked questions which can only be answered by using his unused eyes to see and his hands to feel. In regard to surgical apparatus, the want of practical knowledge must be referred to inadequate instruction in the Hospitals.

## EXAMINATIONS FOR THE DIPLOMA OF FELLOW.

## FIRST EXAMINATION.

ANATOMY AND PHYSIOLOGY; 1870. May 20th, from 1 to 5 o'clock P.M.—Answers to *less* than four questions are not received.\*

1. Describe the entire lachrymal apparatus, its use, and the manner in which its functions are performed. 2. Describe the intrinsic muscles of the larynx; the position, relations, and functions of each, and their nerve supply. Describe particularly the distribution of the motor and sensitive filaments of the superior laryngeal nerve, and the probable origin of each set of filaments. 3. State the chemical composition of bone, and the relative proportion of organic and inorganic matter. Describe the arrangement of the osseous tissue in a long bone—say the tibia. State the sources whence the tibia is supplied with blood, and describe how the arteries permeate its structure. 4. What is the condition of the humerus at birth? Describe its mode of growth in length and thickness, the order in which the epiphyses ossify, and the age at which each epiphysis is united to the shaft. 5. Describe the secretory structure of the liver, and give the arrangement and mode of distribution of the different kinds of vessels, where they reach or leave the lobules. 6. Describe the method of making a side view of the contents of the male pelvis, and give a general description of the parts thereby exposed.

PRACTICAL EXAMINATION ON ANATOMY; May 25th.—This examination has the same *objective* character as that for the diploma of Member, its design being principally to elicit the candidate's personal knowledge of anatomical objects and facts. Hence the common form of question. "What's this or that muscle, artery, or nerve?" But, unlike the examination for the membership, the candidate, as a more advanced student, or as a member, is far more frequently required to *demonstrate* by pointing out and naming the structures presented to view, or perhaps to *describe* the parts seen in an anatomical preparation or a recent dissection. Sometimes, in explanation of statements made, *reasons* are asked. Of this threefold mode of testing the candidate's knowledge, the latter seemed to offer the chief difficulty. The time of examination for each candidate is ten minutes at four tables, severally; a total period of forty minutes.

The anatomical series comprised—(1) Regional dissection in the recent subject, and elaborately prepared parts in spirits under flat glass covers, which were removed as occasion required for examination. (2) Visceral preparations, some injected and displayed in like manner. (3) Developmental anatomy—*e.g.*, of the fœtus, ossification of the bones. (4) Histology, represented by an admirable and highly useful series of mounted specimens under the microscope, eight of which instruments were in use.

The nature of the anatomical objects submitted for examination, and of the questions proposed, may be gathered from the following summary:—

\* By a recent Regulation, 1871, only *four* questions are now put, but *all* must be answered.



Base of the skull, showing the foramina, nerves, and vessels transmitted, represented by coloured wax rods; point out and name the several structures thus indicated. What is this bone? The palate bone. The right or left, and why? Name its processes and foramina. Point out the situation of the spleno palatine ganglion. In the skull, point out the course of the palatine nerves, and of the Vidian nerve. Lateral section of orbit, showing eyeball, muscles, nerves; sphenoid and temporal bones continuous, showing portio dura, &c. Point out the lenticular ganglion; name its connexions with nerves; the nerves supplying the muscles of the eyeball. Select the bones of the internal ear, and describe their relative position and connexions. Describe the structure of the Eustachian tube. What are its functions? Describe the distribution of the auditory nerve. Parotid region: describe the relations of the parotid gland, superficial and deep, and show where the duct enters the mouth. Side view of the muscles of the face, and of the neck in the triangular spaces: point out and name the muscles seen. Another preparation showing also vessels and nerves: what is this or that part seen? Occipital region, showing recti and oblique muscles, nerves, and vessels: name the parts. Constrictors of the pharynx: describe their origin and junction in the pharynx. Vertical section of pharynx posteriorly; showing its openings anteriorly, laterally, and inferiorly: point out and name them. Section of nose and mouth: name the parts seen. Larynx, showing intrinsic muscles: name them. Anatomy of the axilla; the bend of the elbow; the forearm; the palm of the hand; severally subjected to examination. From a collection of small bones, pick out the bones of the carpus, name each of them; and place them in relative position. Anatomy of Scarpa's triangle in the thigh; of the popliteal space; the leg; the sole of the foot; severally subjected to examination. Is this a male or female sacrum, and why? What are the relative directions of the neck of the femur, in the male and in the female? What anatomical mark of distinction is there common to all dorsal vertebræ, and which exists in no other vertebræ? When the abdominal muscles suddenly contract, what action is there on the testes, and why?

Section of the head through the longitudinal sinus, enclosing the encephalon: point out and name the parts seen. Base of the brain: point out the (apparent) origins of the cranial nerves, naming them from before backwards. What parts are supplied by these nerves—*e.g.*, by the third and seventh? Specify the muscles supplied by the portio dura. Section of a portion of the vertebral canal, enclosing the cord and spinal nerves: what region does the portion belong to, and why? Lateral section of the thorax, enclosing heart and lungs, &c.: point out the origin, course, and distribution of the phrenic nerve, &c. Anterior view of thoracic organs, vessels, and nerves: name the parts seen. The diaphragm, showing its upper surface, and circumferential attachments: point out and name the apertures, and the structures passing through them, also the nerves. What shape does the diaphragm assume in inspiration and expiration, respectively? What causes air to enter the lungs? What is the pressure of the atmosphere on the square inch? Pyloric orifice of the stomach, opened duodenum, with gall-bladder, and pancreas: specify these structures, describe their relative position, and relations to surrounding parts. Section of kidney injected: point out the renal vessels, and ureter, as seen at the hilus, and their relative position; an opened calyx and its connexion with a papilla; the structure of the pyramidal and cortical portions.

What is the structure of a Malpighian body? Side view of the pelvis and intra-pelvic organs: describe the parts seen.

*Histology.*—A series of highly useful mounted specimens were submitted to examination under the microscope by each candidate. They comprised, principally, textural anatomy, and the minute structure of some important organs. Thus, I noticed white fibres of fibrous tissue; fat-cells; blood-corpuscles; muscular fibres, voluntary and involuntary; cartilage cells, and intercellular matrix; kidney injected, showing arrangement of the vessels, and structure of Malpighian bodies; choroid coat of the eye. A candidate having recognised any such specimen, would be asked questions of a physiological character pertaining thereto. For example: blood-corpuscles gave rise to questions as to their relative proportion in the blood; the salts of the blood, and their relative proportions; the kind and quantity of gases present; the difference between arterial and venous blood; the changes produced by respiration, and the source of carbonic acid in the blood. In like manner, the minute structure of the kidney led to questions respecting its function as an excreting organ.

By the regulation of January 11th, 1866, students may pass the first examination, or that on Anatomy and Physiology, for the fellowship, at the end of their third year—*i.e.*, between the first and second or pass-examinations for the membership; and this regulation is found to considerably facilitate the arrangements of those who desire to take the higher diploma of Fellow.

#### SECOND EXAMINATION.

**PATHOLOGY, THERAPEUTICS, AND SURGERY, May 26th, from 1 to 5 o'clock, P.M.**—Answers to *less than four* questions are not received.\*

1. Describe the process of reparation which nature adopts to unite fractured bone, divided tendon, muscle, nerve, skin, mucous and serous membranes. 2. Describe the different forms of gangrene which may be produced—first, by disease of arteries; secondly, by lesions of arteries; thirdly, by acute inflammation. State the treatment to be employed in each case, and your reason for its adoption. 3. Describe the treatment which your observation and experience would lead you to adopt for the relief and cure of permanent stricture of the urethra. 4. Mention the different forms of disease, including malignant affection, to which the knee-joint is liable, and which may possibly render amputation or excision necessary. Describe the pathological conditions and the symptoms, local and constitutional, which would induce you to save a diseased knee with the view of obtaining ankylosis. 5. State the symptoms of congenital syphilis, and mention the internal lesions which frequently coexist. Describe the treatment to be adopted. Prescriptions to be written in full. 6. Describe the local symptoms which precede and accompany the formation of phlegmonous suppuration; and state the chemical, physical, and microscopic characters of pus.

**CLINICAL EXAMINATION OF PATIENTS, May 27th.**—For the purpose of conducting this portion of the *practical* examinations, various hospitals are visited, by permission of the authorities, and suitable cases selected by the examiners, agreeably to the surgical staff. Four of the recognised hospitals supplied the requisite amount of clinical cases on the last occa-

\* By a recent Regulation, 1871, only *four* questions are now put, but *all* must be answered.

sion—namely, Guy's, St. Bartholomew's, the London, and Charing-cross hospitals. Two examiners attend each hospital. It will be obvious that this clinical examination must be somewhat restricted in its range, both as to the choice of cases of disease or injury which shall have a fairly marked typical character, and in patients who are able to undergo such examination, however judiciously it may be conducted. The examination is partly written and partly oral. Each candidate is required to examine a patient, and take notes in the form of a short clinical report of symptoms, or signs, and diagnosis. Of course, the bed cards, indicating the nature and treatment of the case, are removed. The time allowed is twenty minutes. The examiners then return and receive the report, folded up, and bearing the candidate's number. He is taken to a second case, one whereon another candidate had been engaged for his written report; he is first requested to examine that case, and then the oral questioning commences, ten minutes being the period. Thus, each candidate is submitted to clinical examination for half an hour. The relative merits of the written and oral modes of examination at the bedside, as a test of clinical knowledge, is a disputed question. But one eminent examiner, who has had experience of both modes, at the University of London and the College of Surgeons respectively, gave his decided opinion in favour of the oral method for eliciting the candidate's qualifications at the bedside.

The following cases and series of questions will illustrate the general nature of this oral examination. Of four cases selected at one hospital, two were well marked by their positive signs, the other two being valuable for examination principally in virtue of their negative signs as compared with other forms of disease or injury.

1. Disease of the hip-joint, without dislocation, in a boy. The student having examined this case, was asked—What is its nature? Point out the signs. What is the state of the joint? In what stage is the disease? How would the articular cartilage disappear? Might the acetabulum be affected? What kind of ankylosis will probably ensue? Why more probably fibrous? What dislocation does this disease of the hip-joint resemble? In morbus coxæ, does dislocation ever ensue? Are any of the viscera likely to be affected? What organs? What is the constitutional character of the patient? Why scrofulous? What is your prognosis in the present case? What treatment? If excision, mark the situation and length of the lines of incision. What vessels or nerves might be wounded in the transverse cut? 2. Sinus-openings, discharging just above the fold of the groin; the thigh is drawn up, but not inverted; the hip-joint is freely moveable, and without pain; the patient a man of middle age, with marked hectic. Is this disease of the hip-joint? You say it is—why so? If not—why not? 3. Injury of hip-joint, in a woman, aged sixty. There is some pain in the joint when moved, and inability to raise the limb from the bed; but there is no shortening nor eversion, and no crepitation can be felt in the joint, nor is there any discoloration about the hip or in the groin, although it should be remembered this might have disappeared, some time having elapsed since the accident. Is this a fracture of the neck of the femur? If not—why not? What treatment? If a fracture—how long would you keep the patient in bed at her age? 4. Secondary syphilis. Copper-coloured, scaly eruption, in a young woman. Name the eruption. What appearances are characteristic? What treatment?



OPERATIONS ON THE DEAD SUBJECT; May 28th.—In the college theatre, converted into a room, two adult subjects were provided, and instruments laid out on adjoining tables. Two examiners were engaged with each candidate. He is requested to perform a certain operation, aided by an assistant when necessary. The candidate is required to select the appropriate instruments, and to give instructions to his assistant—*e.g.*, as to the position of a limb for amputation, or the compression of a main artery. During the operation, or afterwards, questions are asked as to the parts seen or concerned; and lastly, as to the dressing of the wound. A second operation may then be undertaken. There is no specified period for the examination of each candidate.

The following operations may be taken as illustrative of the requirements in this portion of the practical examination:—They comprised amputations, excisions, and the ligature of arteries. Thus, I witnessed amputation of the fingers; at the wrist-joint; in the forearm; at the shoulder-joint; of the great toe, at the tarso-metatarsal articulation; Chopart's operation through the tarsus; and amputation below the knee. Excision of the knee-joint, and of the elbow-joint. Ligature of the sub-clavian artery, in the third portion; of the common carotid; and of the anterior tibial artery.

PATHOLOGY AND SURGERY; May 28th.—This concluding part of the practical examination takes place immediately after the operations, and it is held in the Council-room and large library adjoining. Four tables were placed, and two examiners at each, with osseous specimens, comprising diseased joints and bones, and spirit-preparations of other parts. The candidate passes a quarter of an hour at each of two tables, making half an hour's oral or *visà voce* examination—a longer period by ten minutes than in the corresponding examination for the membership.

The questions are principally and primarily objective; a specimen of diseased joint, for example, being handed to the candidate as the starting point for questions respecting its pathology and surgery. *Senior* candidates are not unfrequently asked, in the first instance, what *cases* they may have seen more particularly in their practice, as fractures or dislocations, and the object for examination is then selected accordingly.

The nature of this examination will be sufficiently exemplified by the following series of questions submitted to one of the candidates:—What is this osseous specimen? A fracture of the neck of the femur. Why so? Was the fracture extracapsular or intracapsular? Is it impacted? Was there any injury to the great trochanter? What age probably was the patient? Mention the signs of extracapsular fracture. Also those of impacted fracture. The treatment of these conditions. What is this? A fracture of the neck of the humerus. What would the signs be? The treatment? Compound dislocation of the elbow-joint, and its treatment. Chronic cystitis: what are its symptoms, and the condition of urine? What is the cause of its alkalinity? What are the elements of carbonate of ammonia? The treatment? Enlarged prostate: give the symptoms; the treatment for retention; the kind of catheter; how to teach the patient to use it. Glaucoma: what are its symptoms? The diagnosis of acute and chronic glaucoma; treatment, by what operation? Describe iridec-tomy. Describe the appearances in the human eye as shown by the ophthalmoscope, in health and disease. Describe Symp's operation at the

ankle-joint. Also Pirogoff's. What conditions are relatively favourable for one amputation rather than the other? Are there any objections to Pirogoff's operation? What is this osseous specimen? Rheumatic arthritis of the hip-joint. What are the characteristic appearances? What the signs? The treatment? What are the distinctive morbid appearances of scrofulous disease of the joint? At what age probably would it occur? What is this specimen? The scapula showing the glenoid cavity of an old dislocation. In amaurosis, what are the various ophthalmoscopic appearances? What are the various specific forms of iritis? The characteristic appearances of rheumatic iritis, and its treatment?

EXAMINATION ON THE PRINCIPLES AND PRACTICE OF MEDICINE; May 27th, from 1.30 to 3 P.M.—1. In what diseases may albumen and blood in the urine occur together, or separately? How do you treat the respective cases? 2. Describe the appearance of a lad who is the subject of well-marked inherited syphilis; also mention some of the complaints amenable to treatment to which he is liable. 3. Mention the various agents employed to produce anæsthesia by inhalation, and their mode of administration.

*Oral or vivâ-voce examination.*—This takes place immediately after the termination of the examination on Pathology and Surgery; the candidates passing on to the adjoining small library. Each candidate is submitted to various questions for a quarter of an hour, by the two examiners in Medicine; and a second quarter of an hour is added when necessary.

Both examinations in Medicine are compulsory, as for the diploma of Member, excepting under the conditions claiming exemption, according to the published regulations of the College. But a candidate who has passed an examination in Medicine for the membership, will not be required to undergo any further examination in Medicine for the fellowship.

*Results.*—On the occasion of the foregoing examinations for the diploma of Fellow, the following results may be interesting:—Primary examination: The number of candidates was 59, being the largest number yet known on any one occasion. 18 were members of more than eight years' standing and therefore were not required to produce certificates of professional examination, or of having passed the preliminary examination in general knowledge. 9 were members of less than eight years, or junior members. 19 had passed the primary or anatomical examination for the membership; the remainder had not passed any professional examination. This fact is significant, as showing that a large proportion of candidates come up at once for the fellowship without previous membership; and it is an increasing number. 10 of the whole number were referred to their studies for six months—*i.e.*, 49 passed. Of the 10, 1 was a senior member, 3 were juniors, 2 had passed the Anatomy for the membership; and 4 no professional examination. This result shows that the examination is made more rigorous to those who had undergone no previous professional examination.—Second or Pass-examination: 21 went in, being 17 out of the 59, and 4 who had passed the anatomical at a previous date. 14 were senior members, 6 junior, and 1 not a member, but who came up at once for the fellowship. 2 candidates, 1 senior and 1 junior, were referred for twelve months. This period is never made less excepting under very special circumstances, as the recall of an army surgeon to India.

In conclusion, I would venture to offer the following general remarks with regard to the fellowship examination:—

Respecting the *written* examination, the qualities of a “good” paper, whether anatomical or surgical, may be gathered from those which I have carefully perused. Each element of any question should be answered, and in successive order; but nothing foreign to the question introduced. Conciseness and brevity are valuable qualities, and especially as enabling the candidate to answer all the questions, and with due allotment of space to each, in the time allowed for examination. In the surgical paper by *senior* members, some reference to the candidate’s own experience of cases may not unreasonably be expected, just briefly stated by way of illustration. Some evidence also of more special reading than could perhaps be gathered from a general text-book on Surgery would indicate that higher and larger range of thought and aspiration which should distinguish a Fellow of the College. References, therefore, to standard authorities on Pathology and Surgery, and to their original observations, can scarcely fail to be acceptable.

In the *practical* examinations, operations on the dead subject are only an undressed rehearsal, as it were, of the representative procedures on the living body, as *surgical* operations. Due allowance therefore must be made for the different, and in some respects unfavourable, circumstances in which candidates are placed at the College. Moreover, the want of an adequate supply of subjects in the schools restricts the opportunities for practice even on the dead body. These, and perhaps other reasons, combine to render the operations at the College the least satisfactory part of the whole course of examination.

THE END.



LONDON:  
SAVILL, EDWARDS AND CO., PRINTERS, CHANDOS STREET,  
COVENT GARDEN.







